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JULY, 1886.

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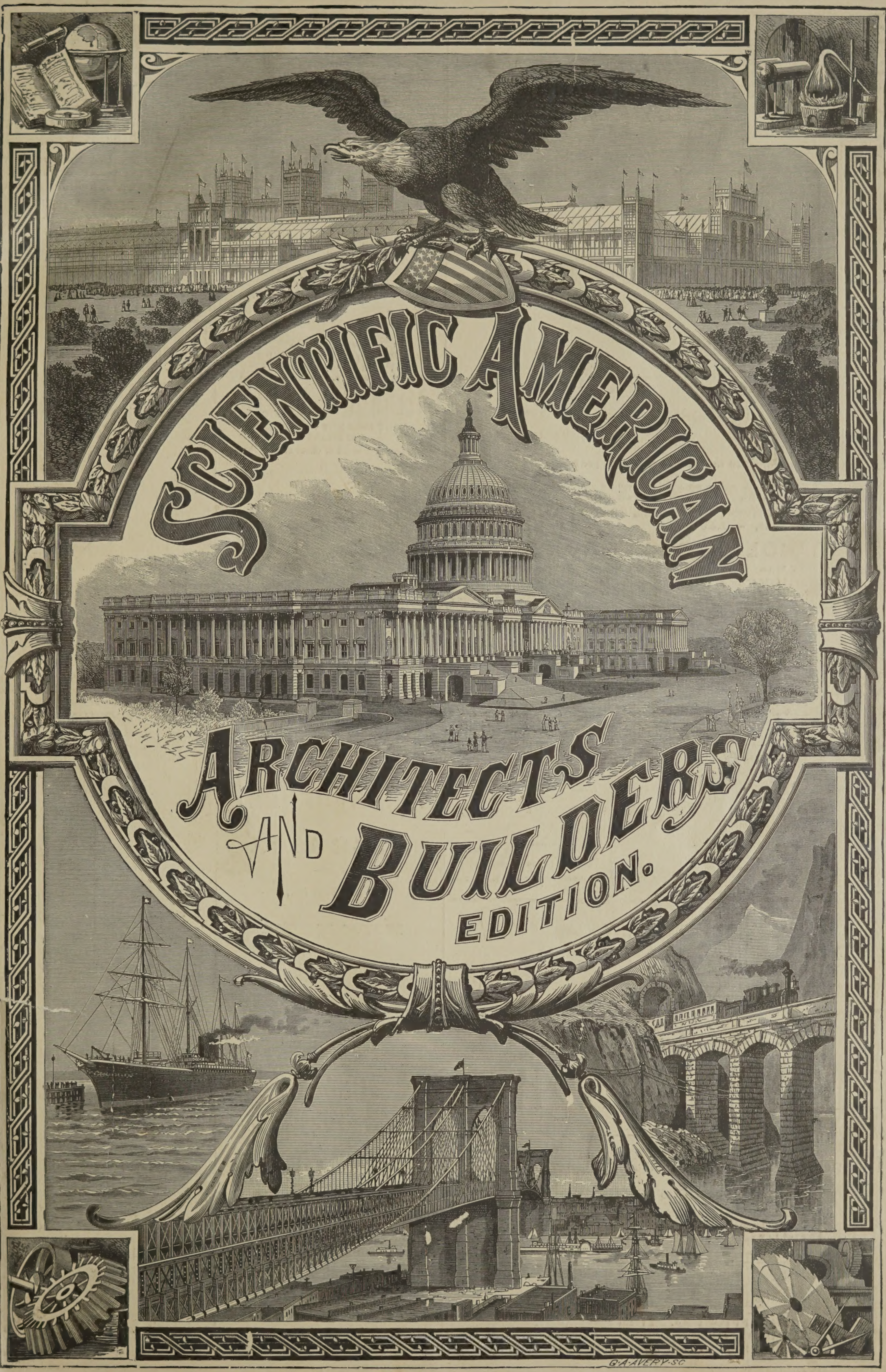

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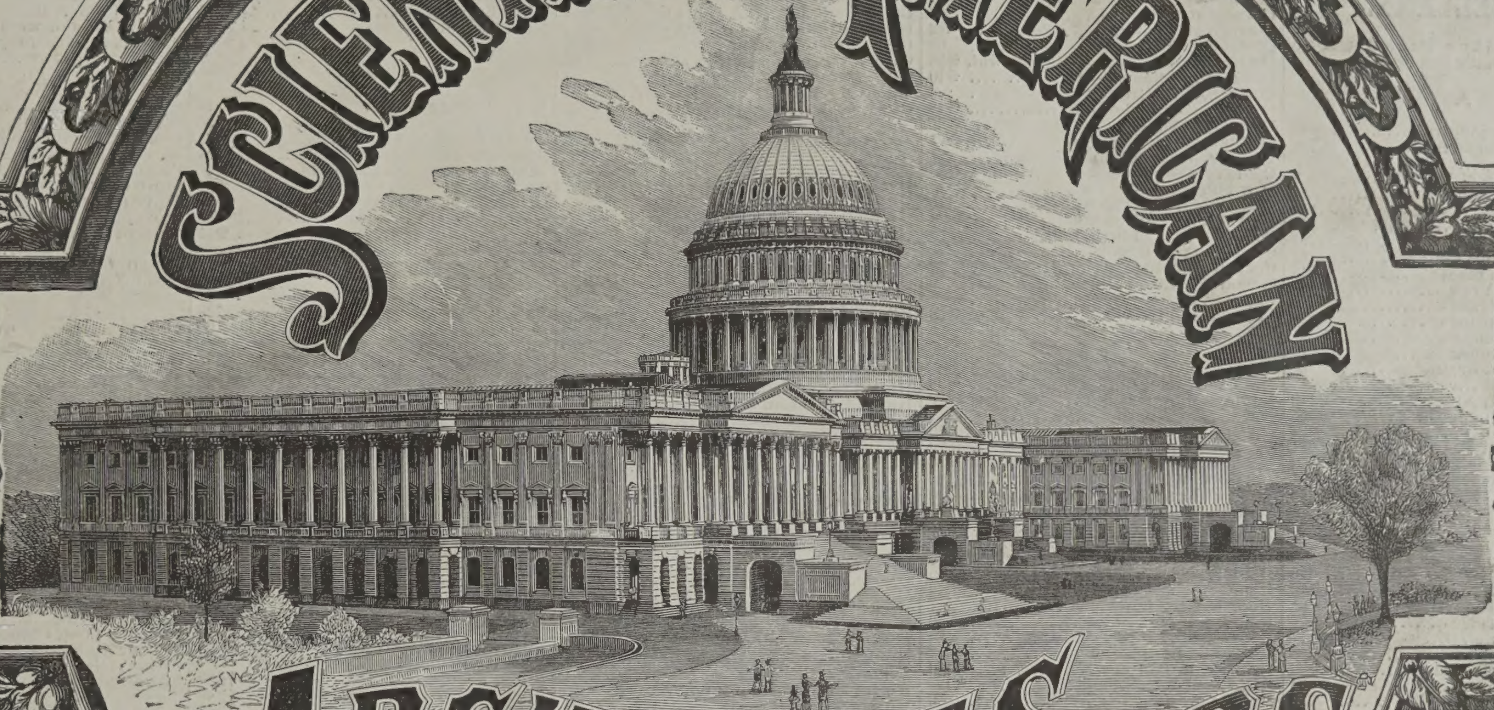

ARCHITECTS AND BUILDERS EDITION.

Vol. II.

JULY—DECEMBER,
1886.

MUNN & CO., PUBLISHERS,
No. 361 Broadway, New York.

INDEX.

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VOLUME II.—JULY—DECEMBER, 1886.

Articles Marked * are Illustrated.

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II. A dwelling at Flatbush, N. Y.; A cottage at Monmouth Beach, N. J.; with plans and plate of details. August.
III. A country residence at Yonkers, N. Y.; A cottage at Block Island, R. I.; with plans and plate of details. September.
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MISCELLANY.

Figures preceded by a *star* (*) refer to illustrated articles.

SCIENTIFIC AMERICAN

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ARCHITECTS AND BUILDERS EDITION.

Vol. II. Subscription, $1.50 a Year. NEW YORK, JULY, 1886. Single Copies, 15 Cents. No. 1.

DESIGN FOR A COTTAGE.

In a former issue we gave the perspective sketch of a country house, "Heath Lodge," Hampstead, Rowland P. Gunde, architect, which we now reproduce. The design has been much admired, and several correspondents have written us, asking for plans. The original plans of the house in question are not now available, but a correspondent has improvised some plans of the first and second stories, specially designed to accord with the sketch, which will doubtless be of value to our readers.

The accommodation provided—three reception rooms and four large bedrooms—would in most cases be amply sufficient for a house of this class, but the plan could be readily altered to suit individual requirements. In adapting the design, the materials used would, of course, vary with the locality in which the house was built and the taste of the owner; but where available, it is suggested that red brick, red tiles, and a warm colored stone should be employed, the half-timbered work being carried out in the usual manner. The cost of the house would be about $3,500, but it would depend largely upon the materials used and the style of interior finish.

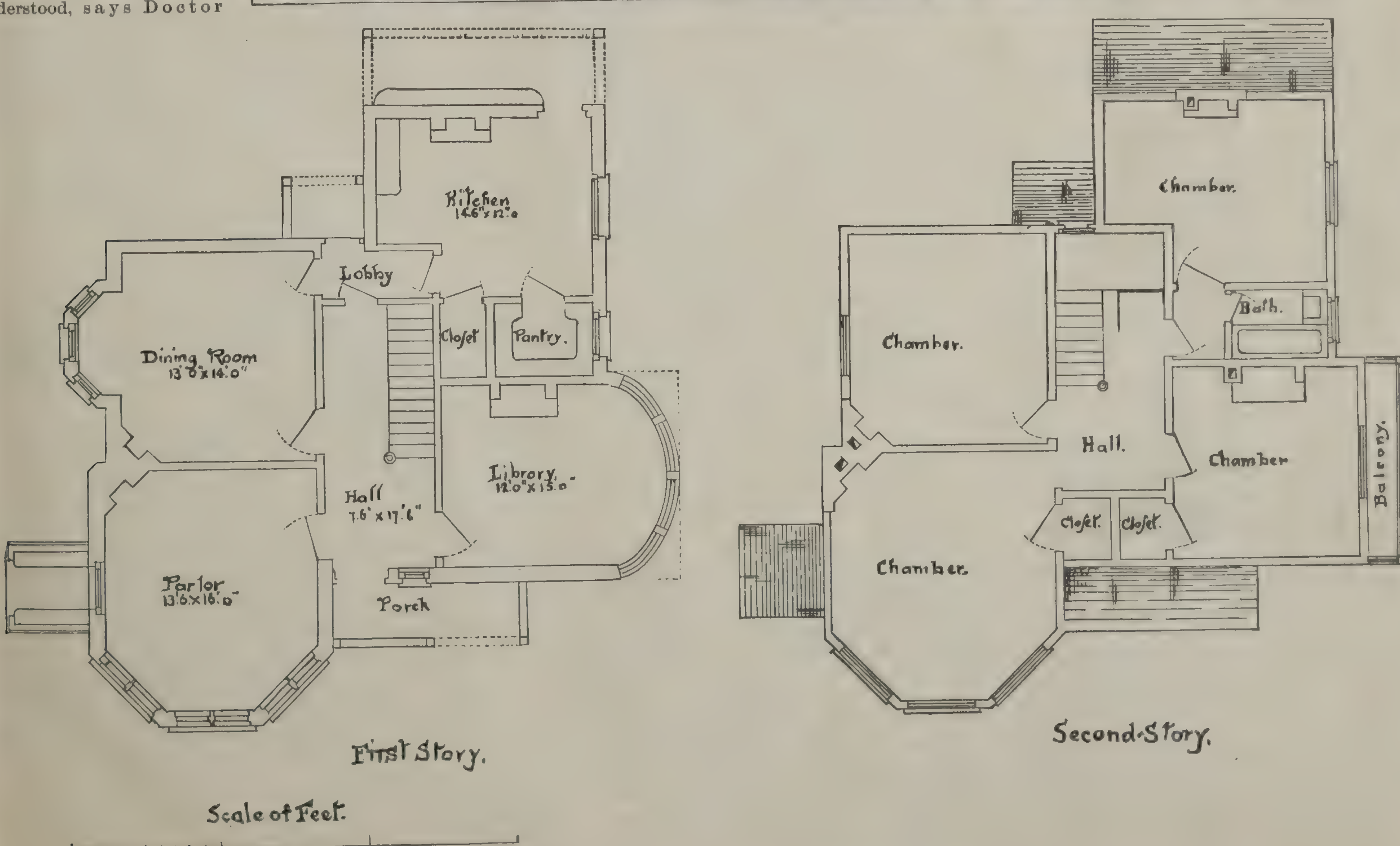
Hints to Bathers.

Although the proper rules for bathing are understood, says Doctor Bailey in the *People's Health Journal*, a few words concerning how and when to bathe will be profitable.

Bathers should enter the water swiftly, not allowing the lower limbs to become chilled, and thus driving the blood to the head. Most of our boys plunge into the water head foremost; but this is not necessary. To submerge the body up to the neck is enough. After this the body resumes an even temperature, and when this course is followed, injurious results are rare.

The common belief that it is necessary to wet the head upon entering the water is based upon the assumption that otherwise too much blood is impelled upward. This is not true if the rest of the body is quickly immersed. Ladies cannot be expected to soak their hair every time they bathe, nor is it necessary that they should do so.

A common error is that of remaining in the water too long. Blue lips, shivering limbs, and subsequent headache should be sufficient warning. A nap after bathing is advised by physicians. Sea bathing induces drowsiness, and has the effect of a sedative and nerve tonic; hence a dip in the salt water just before retiring for the night generally insures sound sleep. When the water is colder than usual, postpone the bath. Because some robust persons can bathe in and out of season, and remain in longer than others, should not induce sensible people to imitate them. Fifteen minutes is quite long enough to remain in the water under ordinary circumstances, and for delicate persons even that short space of time may be injurious. Too violent exercise in the water should be avoided. The extreme fatigue which follows is, in itself, sufficient evidence that it is injurious.



DESIGN FOR A COTTAGE OF MODERATE COST.

Scientific American.

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O. D. MUNN. A. E. BEACH.

NEW YORK, JULY, 1886.

THE

Scientific American,

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This is a Special Trade Edition of THE SCIENTIFIC AMERICAN, issued Monthly—on the first Saturday of the month.

It goes directly *into the hands of those who have the ordering of the great bulk of Building Materials and Appliances*, namely, the Architects, Builders, Constructing Engineers, and Contractors.

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CONTENTS

Of the July number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

Back Numbers.

At present we are able to supply to new subscribers the back numbers of this journal from its beginning in November last. Each number is accompanied by a sheet of colored plates and a sheet of details.

OUR LAST VOLUME AND OUR NEW VOLUME.

With the present, July, number we begin a new volume of our ARCHITECTS' AND BUILDERS' edition. We think our readers will be as well satisfied with the future numbers as they have been in the past. We aim to improve as we progress. We shall be glad to receive suggestions from correspondents with relation to any matters which they think would add to the value or interest of our pages.

We send out with this number the index and title page for Volume I., which will be desirable to all who have preserved the numbers of that volume.

We can now supply complete copies of Volume I., bound in handsome paper covers, for $1.50. Sent by mail to any address on receipt, at this office, of the price. Also supplied by newsdealers and booksellers in all parts of the country.

PROGRESS OF THE A. AND B.

The success of our ARCHITECTS' AND BUILDERS' edition is very gratifying. There is a popular demand for it in all parts of the country. Of the July number, we issue 25,000 copies for the first edition, and the circulation will doubtless be increased beyond this number before the month closes, as subscriptions and sales are fast augmenting. The splendid plates in colors presented with every number, the large supplementary sheets of details, the many fine engravings, elegant typography, large amount of useful reading matter, and the reasonable price—15 cents per copy, $1.50 a year—are obvious reasons why the paper commands, to so great a degree, the approval of the public. It enjoys by far the largest *bona fide* circulation of any paper of its class.

To manufacturers and dealers in all kinds of materials, tools, and appliances used in buildings or works of any kind, our advertising pages present most excellent opportunities for promoting trade. The advertising rates are moderate, the circulation large. Customers will find it pays to advertise in this journal.

WRITERS WANTED.

Architects, builders, and others who are willing to write on any of the various practical subjects pertaining to the sphere of this periodical are cordially invited to do so. The editor will at all times be pleased to receive their contributions, and publish if approved. For special articles special arrangements will be made. We leave to writers the suggestion of such subjects as they think would be of the most interest to readers.

DWELLING AT ORANGE, N. J.

The dwelling represented in our colored plate and in the plans and details issued with this number has lately been erected for Mr. C. S. French, of Brick Church and East Orange, N. J., on the Arlington Avenue, Orange, from the designs of the successful and well known architect, Mr. William Halsey Wood, of 764 Broad Street, Newark, N. J., and 226 Fifth Avenue, New York city. The house is of a particularly interesting character, both from the manner in which it is constructed and the attractive novelty of the design.

The success of Mr. Wood as an architect lies largely in the fact of the strong and pleasing individuality exhibited in his drawings. Designed on sound scientific principles of construction, with a real artistic feeling, his work indicates originality. In the house under construction, the tower at the corner of the building, which is made to form a very pleasing feature in the elevation, is the means of providing a large and very convenient dining room, well lighted by windows commanding, from three points, extensive views of the surrounding country. The principal chamber above forms an equally fine room, light and cool, and the other details of the plan are designed with an equal regard to economical utilization of space.

The bricks used for the facing of the building are of a rich dark brown color, spotted in many places with small black iron patches. The architect, happening to be in the Newark brick yard of Mr. James R. Sayers, caught sight of these peculiar bricks thrown aside as useless.

It seems that they were manufactured from a clay containing a large quantity of iron, in such a form as to cause the brick to assume the peculiar color observed, and also to send the iron out in black bubbles from the surface, projecting in some cases as prominently as three-quarters of an inch. It at once struck Mr. Wood, always ready to receive an artistic impression, how novel and picturesque a building they might be made to form, and he therefore employed them for the face of Mr. French's house. The front bricks are laid in black mortar with a backing of hard Jersey brick. They are laid without regard to bond, in all directions, horizontally, vertically, and obliquely. The chimney, door and window jambs, and all other quoins are finished in red brick with a neat red joint, as shown in the drawings. The cozy appearance in the effect produced by the harmonizing contrast of the colors of the brickwork and the terra cotta ornaments, and in the peculiar rugged appearance of the house, is altogether very satisfactory.

The cost of the building amounted to $5,400, the interior being finished in a somewhat superior manner, and the materials being all of first quality. The foundation walls are properly built on footings, and are brought up in roughly squared work laid in cement mortar, composed of one part of Rosendale cement to two parts of sand. Bond stones are built in the whole of the bottom course and in the main wall at distances apart of about seven feet.

The soft stone used throughout is bluestone, the sills being four inches deep, rock faced; the caps to inside and outside piers quarry dressed; caps to chimneys axed; and kitchen mantels and hearths rubbed. The fireplaces in laundry and kitchen are of Trenton pressed brick, laid in white mortar. The fireplace in the main hall is faced on cheeks, jambs, and front with Trenton pressed bricks, which are also used for all hearths throughout, excepting those of laundry and kitchen.

The joinery throughout is of excellent quality, carefully designed. We give, on our sheet of details, one or two of the principal examples.

A COTTAGE AT MONTCLAIR, N. J.

That it is possible to build a house which shall not be costly, and yet shall have the qualities of a pleasing exterior and well arranged and conveniently sized rooms, is amply proved by the designs for the residence of which we give a full set of drawings and specifications with this issue. The house has lately been erected for Major George A. Miller, on Clairmont avenue, Montclair, New Jersey, by Mr. Christopher Myers, of Montclair, architect and builder, and who is to be congratulated upon the remarkable success of his designs.

It will be seen by our colored plate and from the elevations we give that the exterior of the house is all that can be desired for a building of this class. Substantial in appearance, and yet ornamental, it forms at once a pretty, attractive, and homelike structure. In the planning of the rooms, which is the most difficult part of the problem, Mr. Myers has again been quite successful. While the plan is treated with a due regard to economy of space, the arrangement is such that the rooms are all of a conveniently large size, light and lofty, pleasant and easily accessible, with excellent closet room. Every care has been taken to utilize every inch of space to good advantage, the result being the production of a residence essentially comfortable and convenient in all respects.

The materials employed in the construction of the house are given in full in the specifications below, from an examination of which it will be found that the work and materials throughout have been first class. The total cost of such a residence is about $4,500, which is certainly a low sum for a house of the extent of this one.

SPECIFICATIONS.

Generally.—The specifications and drawings are intended to co-operate, so that any work shown on the drawings and not mentioned in the specifications, or *vice versa*, is to be executed to the true intent and meaning of the said drawings and specifications, without any extra charge whatsoever. The drawings, taken in connection with this specification, are intended to provide for the completion of the entire carpentry, masonry, painting, plumbing, slating, trimming, etc., and everything mentioned in this specification.

MASONRY.

Excavations.—Proper excavations, of depth as shown on plans. The cellar proper to be about $4\frac{1}{2}$ feet deep; all piers and foundations 2 ft. 8 in. deep. Stoop foundations 2 ft. 6 in. deep; also footing course under foundations 4 feet deep. Earth and rubbish to be removed where directed. All water that may accumulate during the excavation, from any cause whatever, to be removed and the premises kept dry.

Stone-Work.—The cellar walls to be of good size "Shrump" or "Newark" quarry stone, 16 in. thick, to the full height of cellar, which will be seven feet in the clear, and to be laid, as shown, in cement and lime mortar, with sharp sand. The stone to be laid bonding, the outside where exposed to view to be pointed and cut in red cement mortar. The inside to be pointed flush and smooth; all angles and corners to be perfectly plumb, and the walls leveled on top. The entire cellar bottom to be cemented with the best Rosendale cement gravel and sharp sand, at least three inches thick, carefully smoothed over on top.

Brick Piers, etc.—Build brick piers, where shown on plans, of good hard burnt Jersey brick, of the dimensions indicated on plans, all piers outside to be excavated for at least 2 ft. 6 in. deep, and filled in with small stone, and well hammered down to a solid bed.

Stoop Stones, etc.—Put down stoop stones where shown, with foundations at least 2 ft. 6 in. deep, and filled in with small stones, and upon them lay flags in two lengths, 2 feet wide and of the full lengths of each and every stoop. Turn trimmer arches to all fireplaces. Furnish and set bluestone steps where shown, with brick risers and stone cheeks and copings.

Chimneys, Flues, etc.—Build chimneys, as shown on plans, of good hard burnt bricks. The joints of all flues to be struck smooth and capped with bluestone caps, 3 in thick, with holes cut in. The kitchen fireplace jambs to be built of Trenton front brick, laid in red mortar. Furnish and set bluestone lintel and hearth rubbed smooth for kitchen. Furnish and set three thimbles where directed.

Cesspool.—Excavate for cesspool, and build same where directed, at a point about 60 ft. from the house, to be 6 ft. by 8 ft. in the clear, laid up with rough field stone and domed on top, covered with flat stone.

Cistern.—Excavate for and build cistern where directed, of good hard burnt brick, laid flat in cement mortar, domed over with flat bluestone top, cemented on the inside and warranted perfectly tight. Cistern to be 10 ft. deep and 8 ft. in diameter, all in the clear, and to be provided with a filter.

Drain Pipes.—Run a 4 in. drain tile pipe from inside of cellar wall to cesspool and a line of 4 in. tile pipe from leaders to cistern.

Vault.—Excavate and build privy vault where directed; a heavy box, made of 2 in. plank, 4 ft. × 4 ft. × 3 ft. 6 in. deep, and tarred, to be inserted.

Plastering.—The entire house, excepting cellar, to be lathed and plastered. The attic rooms and closets to be laid on with one coat and hard finished; all the others to be regular three coat work, and all hard finished, excepting dining room, parlor, library, first and second story, halls, and soffits of stairs, which are to be sand finished in the regular way. The mortar is to lie at least one week before using, and the whole of the work to be done in the very best manner, with the best materials.

Cornices, Center Pieces, etc.—Run 6 in. × 8 in. cornices in parlor, dining room, library, and first story hall, of neat pattern; furnish four center pieces, to cost in all $7, and set same.

The mason to make all his work good after all other trades are done, and to leave the building broom clear immediately after the plastering is finished.

This specification is intended to comprise the whole of the mason's work necessary to fit the building for occupancy, but should anything be omitted necessary to that end, it must be done without extra charge.

CARPENTRY.

Quality.—All the materials used are to be of good quality, free from all defects. All timber, except where otherwise specified, to be of good, well seasoned spruce.

Scantlings.—Girders to be 6 in. × 6 in.; sills, 3 in. × 8 in.; plates and interties, 4 in × 4 in.; post, 4 in. × 6 in.; first and second floor beams, 2 in. × 10 in.; third tier, 2 in. × 9 in.—all 16 in. center to center; rafters, 2 in. × 6 in., hip and valley rafters, 3 in. × 8 in., 24 in. centers; all studding 2 in. × 4 in., 16 in. centers.

Framing.—All door and window studs to be doubled and bridged once on each floor. Partition studs to rest on partitions below, where possible, and not on the floor beams.

Sheathing.—The entire frame, from sill to plate, to be sheathed with one inch hemlock boards, put on diagonally, and well nailed at every post and stud, to be covered with No. 30 Manila building paper, well lapped and laid under door and window frames.

Flooring.—First and second story floors, except kitchen and bath room, to be laid with narrow spruce flooring, well driven together, and nailed to each beam. Attic floor to be of pine, 9½ in. wide, well driven together, and nailed to each beam. Kitchen and bath room to be laid with Georgia pine 2½ in. face.

Siding, etc—Cover entire building, except where otherwise shown on drawings, with sound and clear No. 1 beveled clapboards, laid with not less than one inch lap, nailed even, 16 in., and set nails for putty. Do all necessary furring, and set grounds for all doors.

Roof.—The roof is to be boarded with sound, rough, hemlock boards, covered with tar felt. Valleys and gutters to be lined with the best I. C. charcoal tin; all joints to be carefully soldered.

Do all necessary flashing around chimneys, dormers, bay windows, porches, etc. Slate the entire roof with 16 in × 18 in. black slates. Put up, where required, three tin leaders, connected with the drains where directed.

Piazza.—The sills and bearing timbers for porches to be 3 in × 6 in. floor beams, placed 20 inches from center to center, notched into the sills and well nailed, the floors to be formed of boards 1 inch thick, 4½ in. wide, laid in paint and blind nailed. Steps to have 1¼ in. treads and ⅞ in. risers. The roof to be ceiled and slated and the rafters planed and beaded. Columns, plates balusters, ceiling, etc, to be of white pine worked and trimmed as per details.

Blinds.—All windows, excepting those in cellar and attic are to have 1¼ in. outside blinds, made, hung, and fastened in the best manner, and to be painted three coats.

Exterior.—The water table, corner boards, cornice, window frames, bay windows, porches, and all exterior ornamental work to be made of the best quality white pine in accordance with the drawings. The ends of the rafters overhanging the plate to be worked as per detail.

Window and Door Frames.—Window frames to be made for 1½ in. double-hung sashes, with 1¼ in. pulley and hanging styles, 2 in. sills and ⅞ in. subsills, 2 in. axle pulleys, stops, etc., all complete. The small cellar frames to be made with rabbeted frames cased inside and hung at top with 3 inch narrow butts and proper fastenings. Door frames to be made of 1¼ in. planks with rabbeted jambs. Outside doors to have 1¼ in. outside casings.

Sashes.—All sashes, excepting those in cellar, to be 1½ in. in thickness and of the dimensions and number of lights shown in drawings; to be glazed with second quality American glass. The sashes in cellar to be glazed with third quality glass The double-hung sashes to have best Russian hemp cord, with proper weights and Berlin bronze sash fasts. The window on balcony to be a casement. The upper sashes of dining-room bay, front octagonal bay, east windows in parlor, and windows on stair platforms to be glazed with stained cathedral glass.

Doors.—The front doors to be 2 inches thick, moulded as per plans, upper panels to be glazed with stained cathedral glass. To be hung on 4½ in. loose cast butts; fastened with 4½ in. mortise lock, brass face, wooden furniture, and escutcheons, brass flush bolts, top and bottom. Sliding doors 2 inches thick, with 4 anti-friction sheaves with astragal mortise lock, brass face, flush pulls all complete. Closet doors 1¼ in. thick, paneled and moulded both sides, hung with 4 loose joint butts, fastened with 4½ in. mortise locks, wooden furniture, etc., for principal parts of first story, and hematite for second and third floors. Kitchen closet doors to have reverse bevel-rim locks, with white porcelain furniture. All doors, where necessary, to have rubber-tipped base pins and ash saddles.

Stairs.—Build the stairs as shown on the plans, from first to third stories, with 1¼ in. treads, ⅞ in. risers, and 1¼ in. strings, to be put up in the best manner, the steps to be wedged with glue and supported on strong carriage timbers. Newels, balusters, and hand-rails to be made f red wood, as per details. The whole of the flight from first to second stories to be of red wood.

Trimmings.—The architraves for all doors and windows throughout the house to be 5 inches wide, moulded on face. First and second stories and attic to have trimmed corner blocks. The bases to be 7½ in. wide, moulded on top. The parlor, hall, library, dining-room, and first flight of stairs, to be of redwood, and the remainder well seasoned and clear white pine.

Pantries.—Kitchen pantry to be fitted up with wide shelves on three sides, as directed. China pantries are also to be fitted with shelves. Closets in passage to be provided with drawers at bottom and shelves inclosed with panel doors above. The bedroom closets are to have one shelf and a strip provided with japanned iron coat and hat hooks. Kitchen closet to have five shelves on rabbeted cleats, closet under platform to have one row of shelves, second story passage closet to be shelved, with drawer at bottom.

Kitchen.—Wainscot kitchen with narrow beaded yellow pine matching, 3 ft. high all round and 4 feet behind sink, and put a finishing moulding on top.

Bath Room.—Bath tub to have an ash top and narrow beaded linings in front, and the room to be wainscoted all round to a height of 2 ft. above the fittings.

Tank.—Build tank, where shown, of wide ceiling boards.

PLUMBING.

The plumbing will comprise and include the stationary tubs, sink and pump, range, furnace, bath tub, and system of gas pipes and lights. The whole of the work to be executed in the best manner, and left complete in all respects.

Mantels.—The dining room, parlor, and two bed rooms on second floor to be furnished with mantels and grates.

Painting.—All the exterior woodwork usually painted, including privy, to be painted two good coats of white lead and linseed oil paint. All knots to be well shellacked before priming, and all cracks, joints, and nail holes to be well puttied after priming is done. All tin work to have two coats of Prince's metallic paint. The whole of the colors to be selected by the owner. The blinds to be painted at the factory. The interior woodwork to be filled with Wheeler's wood filler, and then varnished with two good coats of the very best varnish. The first story and main stairs and balusters are to be rubbed down to a smooth surface. The doors, saddles, hearth borders, and hard floors to be oiled. All sashes and outside doors to be painted top and bottom, the painting to immediately follow the carpenter's work.

Vine for Porches.

There is no more desirable vine for covering trellises and porches than a wiseteria It is strong, and a rapid grower. When well established, it will grow twenty feet or more in one season It flowers profusely in long, graceful clusters. A large plant in bloom is a beautiful sight.

A Fruitful Five Do

A little money sometimes goes illustration of this read the followi incident which is said to have really

A owed $15 to B; B owed $20 to C D owed $30 to E; E owed $12.50 t to A.

They were all seated at the same tab

A having a $5 note handed it to B, r it paid $5 of the $15 he owed B.

B passed the note to C with the remark $5 of $20 which he owed.

C passed it to D, and paid with it $5 of owed D.

D handed it to E in part payment of th owed him.

E gave it to F, to apply on account of the due him.

F passed it back to A, saying: "This pays ha amount I owe you."

A again passed it to B, saying: "I now owe only $5."

B passed it again to C, with the remark: "This r duces my indebtedness to $10."

C again passed it to D, reducing his indebtedness to $5.

D paid it over to E, saying: "I now owe you $20."

E handed it again to F, saying: "This reduces my indebtedness to you to $2.50."

Again F handed the note to A, saying: "Now I don't owe you anything."

A passed it immediately to B, thus canceling the balance of his indebtedness.

B handed it to C, reducing his indebtedness to $5.

C canceled the balance of his debt to D by handing the note to him.

D paid it again to E, saying: "I now owe you $15"

Then E remarked to F: "If you will give me $2.50, this will settle my indebtedness to you."

F took $2.50 from his pocket, handed it to E, and returned the $5 note to his pocket, and thus the spell was broken, the single $5 having paid $82.50, and canceled A's debt to B, C's debt to D, E's debt to F, and F's debt to A, and at the same time having reduced B's debt to C from $20 to $5 and D's debt to E from $30 to $15.

Moral: "Here a little and there a little" helps to pay off large scores. Money circulates from hand to hand, and business moves. Pay your debts in full, if you can, and if you can't pay in full, pay something. What helps one helps another, and so the round is made.—*American Merchant.*

Large Cows and Little Milk.

The *Farmers'* (Irish) *Gazette* says: The dairyman who buys a big cow, giving a little mess of milk, for the sake of having her heavy weight as a basis for beef at the termination of her usefulness, is like a manufacturer who buys a big steam engine for doing a little work, for the sake of having a heavy weight of old iron to sell when the engine is done with. The waste of food for keeping the excessive weight of the big cow warm, and the waste of steam in keeping hot the needless iron in the big engine, are very analogous, and there is a striking similarity between the old iron in a worn-out engine and the beef in a worn-out cow.

The editor also gives the following reasons why the last milk drawn from the udder is the richest in cream: Because, he says, it is at the top of the bag when milking begins, but follows down as the milk is drawn out. Probably the heavier milk sinks to the bottom of the bag during the twelve or more hours between milkings, and the heavier milk is the smaller in its proportion of cream. This first milk is, however, rich enough for calves, if they have plenty of it; but it is better to milk it separately than to let the calf suck. The latter process tends to diminish the flow of milk, especially if the sucking is at irregular intervals. If a cow were milked clean every six hours through the twenty-four, both the yield and richness of milk would be increased. While the milk is in the bag, some of its fat is absorbed and goes to the cow. And to make the milk originally, some fat is taken from the cow. Hence, if a cow were milked every one or two hours, she would lose flesh, no matter how highly fed. She would be constantly giving out fat to make milk, which would be taken nearly as soon as made.

Drawings and Plans.

Architects and builders who have plans of buildings they wish reproduced in this paper are requested to communicate with the editor. When the picture is to be reproduced in colors, a drawing should be furnished colored substantially as the author desires to have it appear when published. When the picture is to be done in black lines, like an ordinary engraving, a line drawing is required, with the usual plans of floors. In each case we aim to give full credit to the author, who derives essential benefit therefrom, owing to the large circulation of our work.

[...he Garden.]

[...]OOD SHADE TREES.

[...]here there is such a wide selection [...] suited for planting for shade, it is [...]atter to decide upon the particular [...]most generally adapted to the pur[...]however, that it will be a difficult [...]e choice of a tree which has a better [...] than the sycamore. When shade is [...]bject for which a tree is planted, more [...]ught of the character of its foliage and [...]it than about the value of its timber [...]wo qualities, however, can be found in one [...] is, of course, all the more valuable. It is [...]ll known among planters that the wood of [...]more is now about as valuable as that of any [...] tree grown in this country, and that, so far as [...]rances can guide us, it is likely to be so in the [...]e. This circumstance, then, I take it, is a suffi[...] reason for placing the sycamore first on the list [...]hade trees, as, although there are other species of [...]est trees which have as great a claim in respect [...] their foliage, they fall short in the worth of their [...]imber. The sycamore is also a tree which grows at a fairly rapid rate, and will thrive in many situations On very high and dry sites it is not to be recommended, as its habitat is naturally more moist. In saying this, it must not, however, be assumed that any wet or marshy soil will do for the sycamore, as, although it is averse to very high and dry positions, it is equally unfitted for boggy or undrained land. In the range of soils between these two extremes, the park or grounds attached to residences is mostly found. There are, therefore, few such places where a suitable spot for the sycamore cannot be determined on.

The Lime.—This is another useful shade tree, and one which will bring a return for its timber. Of the European lime tree there appear to be several different species, but Loudon regards them as merely varieties. In whatever way this may be decided, it will not affect the question of its suitability for planting as a shade tree Its foliage, though of a quite different character from the sycamore, is very abundant. In many respects it is a tree which would grow well in similar soils to those in which the sycamore thrives It is adapted either for forming avenues or propagating as isolated specimens. Growing as it does to a large size, it is often capable of shading a very large area. One of its remarkable qualities is its fragrance when in flower, and it contrasts well with other trees.

The Beech.—There are, I know, some other trees which, if the foliage only was regarded, would be entitled to a place in the list before the beech, but looking at utility and ornament together, this is a tree which must always hold a high place. A moment's thought of the way in which the beech has been planted generations ago will be a sufficiently convincing proof of this.

Though its leaves are smaller than those of most trees which are regarded as the best for shade, they are so abundant and closely set that its shade is as dense as that of almost any tree. There is, too, another point which is a recommendation of the beech, viz., that it will grow on lighter soils and in more exposed places than the trees which have previously been mentioned generally succeed in.

The Wych Elm.—Looked at in the light of growing in places where many trees will not, the Wych elm has the title to an honorable place among shade trees. Where the common elm grows best, many other trees which are possessed of a more dense foliage thrive well but the Wych elm often makes a fine spreading tree at a much greater height and on poorer soil. There are some trees which I have lately noticed of this species which are really beautiful objects, and which are developing such an abundance of leaves as to afford a most grateful shade.

The Horse Chestnut.—It will perhaps be thought that this magnificent tree has been overlooked, or that it has been relegated to too low a place among trees for shade. It has, however, been intentionally placed here, as, although a good specimen of this species, of itself, forms a most delightful retreat from the rays of the sun, its timber is of so little value that it seriously reduces its chance of being more extensively planted. It is true that shade is not often very greatly needed early in the season, otherwise another great point in favor of the horse chestnut would be the date at which its foliage becomes fully developed. At the present time [the first week in May] it is in splendid condition, although it is not yet fully in flower. It is a tree which succeeds in a variety of soils, and which often reaches considerable dimensions in high and dry situations. It has also the advantage of being a rapid grower.

The Plane.—This tree, which is so familiar to every Londoner, and also to every one who has occasion to visit the metropolis, must certainly be mentioned as a valuable shade tree. Its especial value, no doubt, is that it will grow where most other trees would languish, *i. e.*, within the limits of the smoke of great cities. Those who live where so many species will thrive may well spare this tree to their less favored brethren, as for country planting it will rank with others of its class without any especial points upon which it is to be preferred.

The Walnut.—Hitherto no tree has been spoken of which will both supply shade and produce an edible fruit. These two qualities are combined in the walnut, and until late years it possessed a third important quality, viz., the value of its wood. There are some trees which afford better shade in their mature years than when younger, but, as a general rule, a comparatively young walnut makes a good shade tree. It is a tree which will grow on a drier soil than many species of shade trees, and for the production of fruit its being planted where the subsoil is rocky is recommended.

SYCAMORE FOLIAGE AND "KEYS."

The Common Pear.—Another tree which, when grown to good dimensions, often gives a capital shade, is the common pear. This is a step further from what is generally looked upon as purely timber trees than the walnut. It is, nevertheless, a tree which is worthy of attention beyond the mere property it has of growing an edible fruit. The timber of the pear, too, is useful for many purposes.

The Willows.—There are many forms of the willow which may be regarded as shade trees, although their foliage is by no means so dense as most of those which have been enumerated. When allowed to grow in their natural habit, they often assume very spreading and graceful shapes, and supply a shade which, if more slight, is not always the less agreeable.

In running through this list, a few only of what may claim to be good shade trees have been touched upon, but enough has been said to show that there is room for the use of judgment in using what is adapted for shade as well as for the many other points which the planter has to keep in view. Evergreens have purposely been left out of these remarks, as deciduous trees serve every purpose for which shade can possibly be required. Shelter, of course, is a very different thing.

D. J. Yeo.

Columnar Structure in Trap.

An excellent example of columnar structure in trap rock is found in the Orange Mountain, New Jersey, and has been studied with considerable care by Mr. Iddings, of the National Survey, whose home is in Orange. The base of the mountain is formed of beds of red sandstone, dipping gently to the northwest. These are capped by a layer of trap, about a hundred feet in thickness. The exposure of the cross section is, therefore, on the eastern face, where the trap is visible as a well defined cliff.

Its lower portion is concealed under the talus of angular fragments characteristic of trap, but in several places the full exposure has been obtained at the quarries supplying the material for the macadamized roads of the neighborhood. In all of these openings a more or less distinctly columnar structure is noticeable. There are two quarries, however, in and near Llewellyn Park, which are of special interest from the size of the columns and the converging arrangement of the groups.

Though less imposing than the famous Giant's Causeway, on the northeast coast of Ireland, both structures are the result of the same force of contraction acting along planes which are generally parallel with the bedding. The more southern of the two quarries has become quite well known from its large vertical columns, from two to three feet thick and about thirty feet high. They differ considerably in their number of faces, some having four, others five or even six. The surfaces are warped, giving the columns a wavy form. While they diminish in height toward the north, their breadth remains constant. They are overlaid by long, slender columns, meeting them at different inclinations. The majority of these converge toward a center at the top of the cliff, about 95 feet from the base of the quarry.

The tops of the larger vertical columns taper off and curve over on one another, in a direction away from the convergence of the upper columns. The two series, in spite of their difference in size and inclination, blend together at the line of junction. The position of the slender columns varies from the horizontal to the vertical, and they converge toward more than one focus. In the more northern quarry this fan-shape disposition is particularly noticeable. The columns radiate downward from foci at the surface, 50 to 100 feet apart. Seven or eight centers can be distinctly traced on the face of the exposure. Below the columns the trap rock is massive, and though, at a little distance, a well marked line of contact is apparent, a closer inspection shows that no line of separation exists. The columns descend unevenly upon their pedestal, and at all angles, but the rock itself passes uninterruptedly from one to the other.

The trap is composed of feldspar, angite, magnetic oxide of iron, and considerable green serpentine or chlorite, formed from the alteration of the olivene. It is, therefore, strictly a basalt, and should be so termed. When first broken, the rock is dark, bluish-black, but often changes to a greenish color on the surface, from the drying out of the serpentine or chlorite.

Mr. Iddings regards it as highly probable that the rock occurred as a surface flow. In its glassy nature, and the disposition of the columns, it resembles many lava sheets in the West, where the irregular cooling may be directly traced to surface inequalities, or else to local porosity or cavities formed within the mass.

Regilding Frames.

The "German gilt" frames are well known, some of the best quality being so clever in their imitation of gold as to deceive any but an expert. In course of time, however, most of them become blanched and "washed out" looking, and a knowledge of a method of making a varnish to restore their color may be useful. It is of course understood that the metallic appearance comes from an actual coating of metal upon the frame; it is white in color, and the gold appearance is given by a colored varnish, for making which the following has been given to us as an excellent recipe: Reduce thirty grains of gamboge and half an ounce of dragon's blood to coarse powder, and add to thirty grains of turmeric powder and two and a half ounces each of shellac and sandarac. Place in a bottle with a pint of turpentine, and, keeping it in a warm place for fourteen days, shake at intervals. Filter, and add four ounces of mastic varnish. This is to be applied with a brush to metal-coated frames. —*British Journal of Photography.*

Matapalo, the Tree Killer.

One of the forest curiosities of the Isthmus of Darien and lower Central America is the tree killer (matapalo). This starts in life as a climber upon the trunk of large forest trees, and, owing to its marvelously rapid growth, soon reaches the lower branches. It then begins to throw out many shoots, which entwine themselves all around the trunk and branches, and also aerial tendrils, which, as soon as they reach the ground, take root. In a few years this gigantic parasite will completely envelop the trunk of the tree which has upheld it, and kill it. The whole of the inner dead tree will then rot away, leaving the hollow matapalo standing alone and flourishing.

VIEWS IN THE CHINESE QUARTER, SAN FRANCISCO.

1. Altar in the Josh House. 2. Jackson St.—principal business street in Chinese district. 3. Chinese Block on the Plaza. 4. Sacramento St. 5. Dwellings of the Chinese poor. 6. Council Room of the Chinese Authorities. 7. Wholesale business houses. 8. Residences of Merchants. 9. Chinese Company Headquarters. 10. Restaurant on Dupont St.

r Poisoning Case.

l *Journal and Transactions* for count of a singular instance of gham, whereby two children lost o others were made very ill. The s instance was an apparently harm- re containing the following four in- of violets, vine of ipe- f sweet al-

oms that ap- wo or three of n that had been s medicine were gular, the pulse ermittent. In the one of the children ed, there was an in- sion of every third rth beat of the pulse. heart's action was very ch interfered with, ere being an intermission one in four or five beats. The pulses of the third and fourth children also intermitted, so that it was evident that there was some peculiar action in their hearts. In considering these symptoms, it seemed to the medical men that there were only one or two preparations which were likely to produce that action. One was a mixture of digitalis, or common foxglove, and the other the sirup of squill.

In order to ascertain whether the action was due to the latter, and the result not due to any accidental mixing or dispensing of the medicine, the coroner had the prescription made up by an independent chemist, and a second time by the chemist (Mr. Wakefield) who originally dispensed it. These prescriptions were placed in the hands of Dr. Truman, the public analyst, who injected samples therefrom under the skins of frogs. In the case of the mixture made by the independent chemist there was no slowing of the heart in an hour and three-quarters, when he killed the frog. In the case of the mixture made by Mr. Wakefield there was a total cessation of the heart's action in seventeen minutes. The mixture made by Mr. Wakefield was much more bitter than that made by the other chemist.

Dr. Truman, on considering which of the four ingredients of the mixture was most likely to contain the poison, came to the conclusion that it must be either the ipecac or the squill. The wine of ipecac gave purely negative results in both cases. He then injected ten drops of the sirup of squill from an independent chemist into a frog, and that slowed the heart's action from twenty-four beats a minute to ten in two hours and a half, when he killed it.

The same amount of Mr. Wakefield's sirup of squill was injected in the same way, and it produced a slowing of the heart's action from twenty-eight beats a minute to fourteen in forty-four minutes, and a total cessation of the heart's action by death in two hours.

He afterward made another series of experiments, in which he took larger quanties of the sirup of squill, and he had quantities of it from two independent chemists as well as Mr. Wakefield's. He repeated the experiments in the same way. In the case of the first independent chemist there was no slowing of the heart's action in forty minutes. In the second case there was a slowing of from thirty-one to ten beats a minute in forty-seven minutes, and in Mr. Wakefield's case there was a slowing of from thirty-six beats to one beat per minute in thirty-eight minutes. That fact, Dr. Truman thought, showed that the active agent was present in the sirup of squill. Mr. Wakefield's sirup of squill was very much more bitter and of very much deeper yellow than the other sirups. Both his prescriptions contained very strong heart poison which agreed in its essential characteristics with digitalis. The squill is a bulb gathered in Russia and Germany. In a squill there is found a minute and innocuous proportion of an active principle producing the same effect as digitalis, the quantity of which may be exaggerated by difference of climate, difference in the period of gathering, and it is also present to a greater degree in the outer scales and in the recent bulbs than in the inner part of the dry bulb. The vinegar of squill from which Mr. Wakefield prepared his sirup was purchased from a wholesale druggist, and probably contained an unusually large amount of the active principle of the bulb. Sirup of squill is in very common use as a remedy for coughs, and as it has hitherto been looked upon as rather a harmless medicine, this is an interesting and unique case.

A COMBINED CRUSHER AND STAMP MILL.

It is rare that a new principle is applied in grinding machinery. The stamp, buhr-stone, and roll are the ancient and approved methods of rock reduction, and no successful machine has heretofore been constructed for rock grinding that has not adopted some form of these elementary machines. But in all old pulverizer the process of grinding is a mutual one, the mill as well as the rock being ground. The Sturtevant mill, here illustrated, is a departure from all old methods, and the results accomplished are so remarkable, and the plan of the machine so entirely novel, as to constitute a matter of unusual public interest.

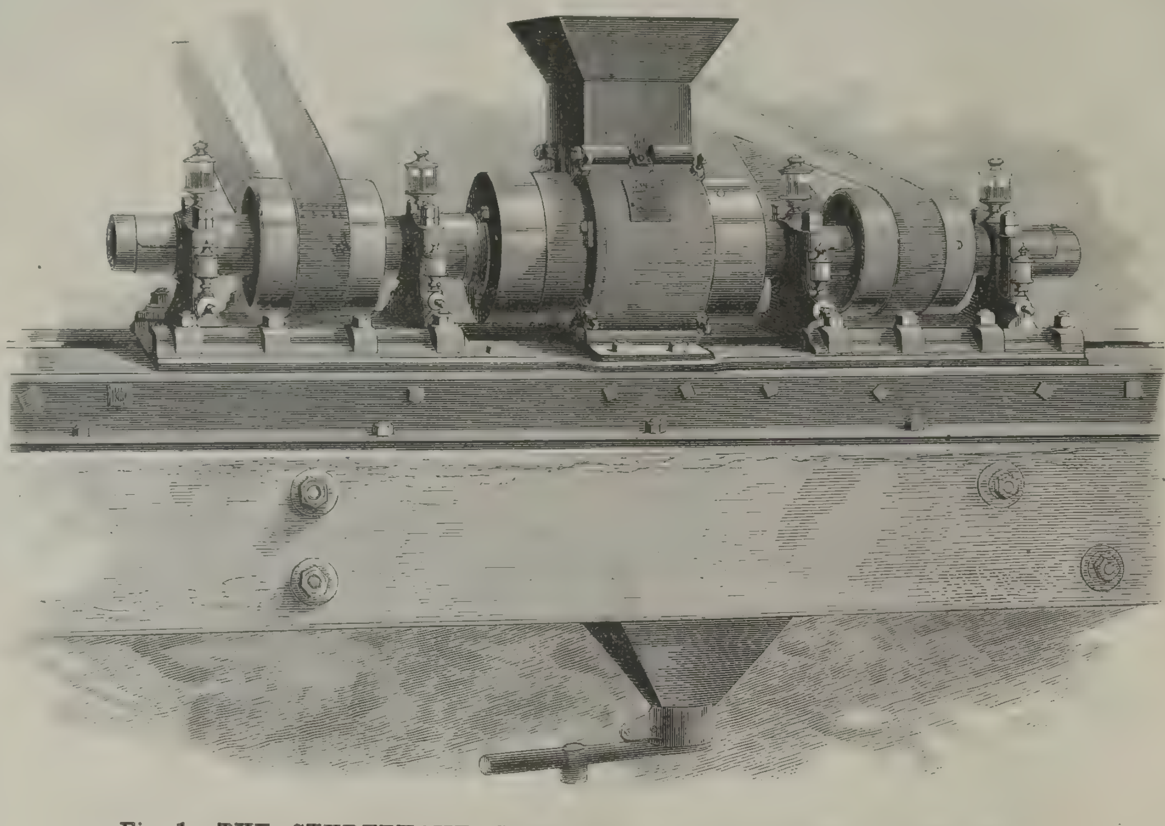


Fig. 1.—THE STURTEVANT COMBINED CRUSHER AND STAMP MILL.

The Sturtevant mill is a combined crusher and pulverizer, seizing rocks of a large size and compelling them to pulverize each other in a most rapid and remarkable manner.

Making the rock do its own crushing and pulverizing is the novel and principal feature of the machine illustrated by the accompanying engravings. It is apparent that if by means of any mechanical contrivance the rock could be made to act upon and disintegrate itself without being crushed or ground between the faces of metal pieces, the machine would be subjected to a minimum amount of wear. Such being the case, it would naturally follow that the power expended in doing a certain work would be greatly reduced, while the capacity, or quantity of rock crushed, would be greatly increased. These desirable results are accomplished by the Sturtevant mill, which, as will be seen from the following description and the cuts, is very simple in construction. And is so arranged that it reduces the hardest materials with scarcely any damage to itself.

The two cylindrical heads or cups are placed upon opposite sides of a case, into which they slightly project, facing each other, and are made to revolve in contrary directions. The rock is conveyed to the interior of the case (which is kept full) through an opening at the top, and is prevented from dropping below the heads by a cast iron screen. The rock is then immediately thrown out by centrifugal force from the two revolving cups, in opposite directions, and with such force that the rock from one cup, coming in collision with the rock thrown oppositely from the other cup, is broken and pulverized, and the grinding, which would otherwise be upon the mill, is transferred to the material, which is at once reduced to powder; in other words, the mill does not grind the substance, but simply provides the power that compels the rocks to crush themselves.

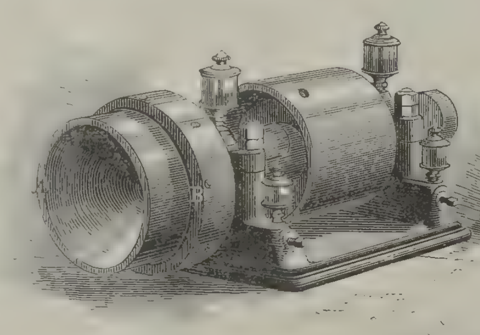


Fig. 3.—THE STURTEVANT MILL.—THE REVOLVING HEAD.

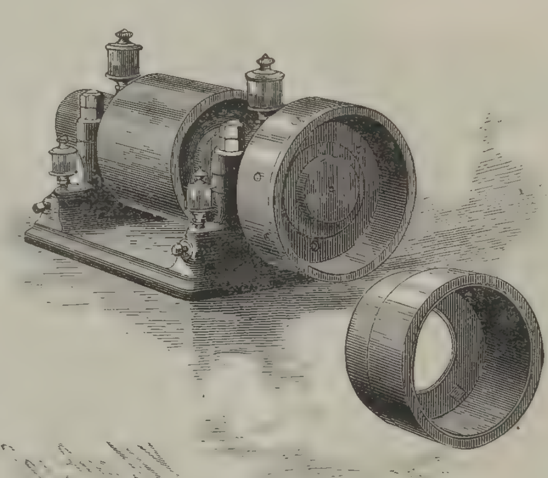


Fig. 4.—THE REVOLVING HEAD TAKEN APART.

The cast iron screen, shown in Fig. 2, in which both revolving heads are drawn back, is composed of small sections which can be easily replaced whenever required. The wear upon this screen is slight, as it is always protected from the action of the rocks thrown from the heads by a cushion of interposing material formed by the rocks, which constantly fill the case and cover the screen. The crushed rock passes through this screen and falls into a bin. When necessary to reduce the rock to a greater fineness than the screen outlets al-

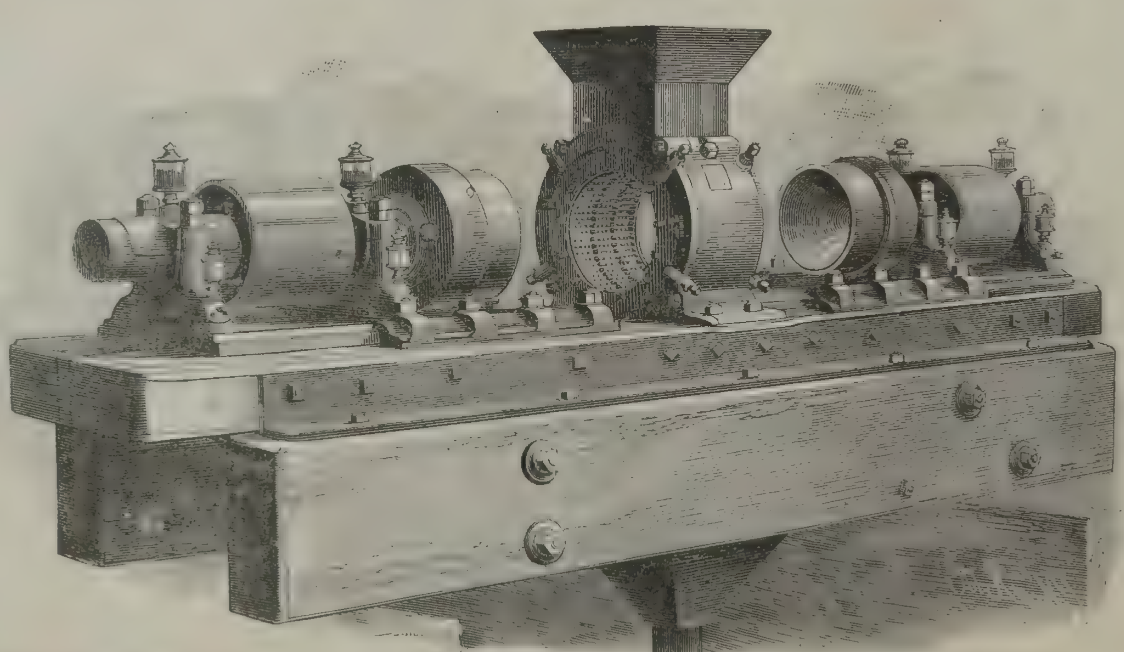


Fig. 2.—THE STURTEVANT MILL, WITH HEADS DRAWN BACK TO SHOW THE INTERIOR.

low, the coarser part of what leaves the screen is reconveyed to the mill by an elevator for regrinding; that which is fine enough being first removed by the usual apparatus adopted in milling. A suction blower causes the air to draw strongly into the mill, thereby preventing the escape of dust.

The revolving heads, shown with the parts assembled in Fig. 3 and separated in Fig 4, are each composed of two parts, one of which, A, a simple hard iron cylinder, called a bushing, is removable, and when worn can be easily taken out and replaced. As soon as the mill has been put in operation, a curious formation is made inside of the head of a conical, cup-like stone lining (Figs. 3 and 5), formed by the caking within the head of the material being ground. This lining is of the utmost importance, as it is a complete shield to these parts of the machine. With the exception of the edges of the bushings, the entire interior of the machine is completely protected from wear by the rock itself.

The elementary parts of the mill are clearly shown in Fig. 5. The end of each shaft carries a head holding a bushing that projects a little way into the case. Within each bushing is shown the hollow stone cone formed by the packing of the rock. The hopper is filled with rocks that drop into the case between the heads. The arrows on the shafts indicate the direction of revolution of the two shafts. Immediately after starting, the stone cones form themselves, and become as hard as the rock itself. When these stone cones have been formed, it is apparent that the centrifugal force given by their revolution will hurl out all the rocks forced into them, in the general direction indicated by the arrows. The flying rocks are sure to collide with those moving in the opposite direction, as their journey is made through an atmosphere of the same material, for the mill is kept constantly filled. These collisions result in rapid and perfect crushing, and the rocks expend their force upon each other before reaching the iron work of the machine.

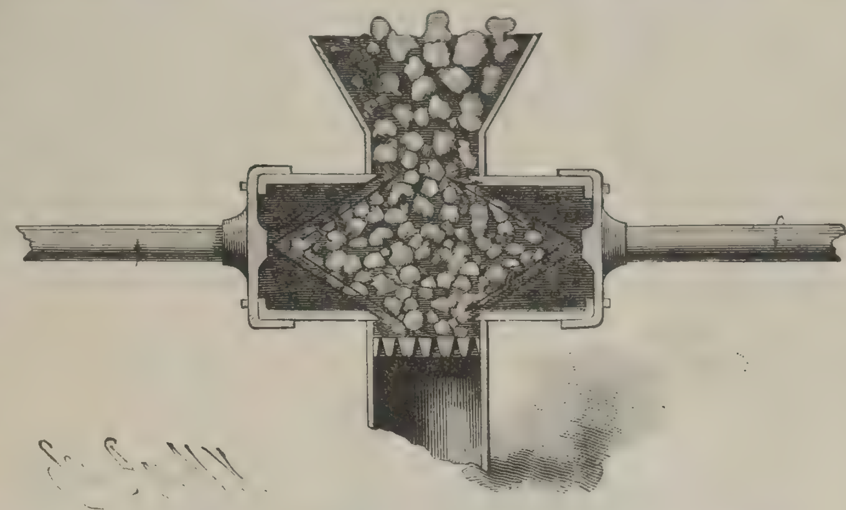


Fig. 5.—ELEMENTARY PARTS OF THE STURTEVANT MILL.

The iron screen is of very small diameter, and the ground rock is let out at once. This is a great economy, for to strike rock after it is once reduced to the fineness wanted is a serious waste of power, and, in metal-bearing rock, to leave a particle of free metal in a machine to be churned and pounded over and over again many times, and worn away, would be often to suffer a great loss.

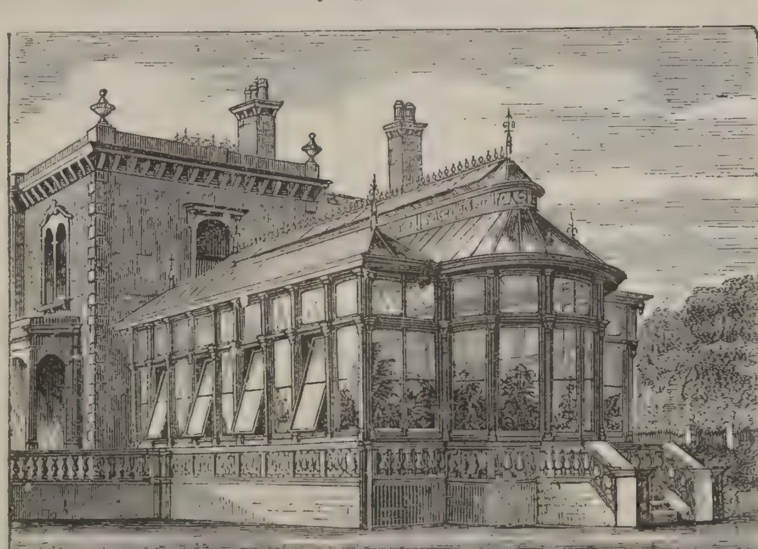
These mills are manufactured by the Sturtevant Mill Company, of 89 Mason Building, Boston, Mass. They are made in six sizes, with heads from 4 to 36 inches in diameter.

Some idea of their capacity may be obtained from the fact that the 20 inch mill will discharge from sixteen to twenty tons of hard rock per hour, and the 36 inch mill will reduce 1,500 tons of hard rock per day.

These giant grinders are of small size, and all of the power transmitted by the belts acts directly upon the rocks reducing each other.

DESIGN FOR A HOUSE CONSERVATORY.

The attachment to country houses of a conservatory or greenhouse is in many cases extremely desirable. The accompanying sketch shows a suggestive little design in that direction. The charms of a conservatory are considerably enhanced by building it directly against a house, as in this case, so that one may step out directly from the dwelling into the society of flowers.



DESIGN FOR A HOUSE CONSERVATORY.

Tests for Bricks.

It is of the utmost importance to ascertain with some considerable degree of accuracy the quality of a brick as to its strength and probable durability. The quality will depend upon the description of clay from which the brick was made and upon the subsequent treatment of the clay, and the process and degree of burning undergone by the brick. The tests requisite for the purpose are, for the most part, very simple, and can be carried out without the aid of any special apparatus. In executing a series of such tests, the bricks should be first examined when in the stack, to see whether the color of them collectively is uniform. If the bricks are of the variety termed "gray" bricks, those having a reddish tint will probably be underburnt; if "red" bricks, those of the lightest color will be those which are not sufficiently well baked. These should be taken out of the stack and rejected. A quantity of bricks in a stack will sometimes be found blackened at the surface, often being misshapen and partially vitrified; sometimes several are found adhering together. Such bricks have been overburnt, and will be very hard. If of sufficiently good shape, they will be suitable for the footings of the walls where hand bricks are required.

Having carefully examined the stack and rejected those bricks which are underburnt, the following tests should then be applied. Take two bricks and clap them smartly against one another, or hit one a blow with a trowel, when they should give out a clear, ring-ing, bell-like sound. Suspend a brick by a cord and hit it with a trowel, when the clearness of the sound will be more marked. If the sound in either case is dull, the bricks were probably made from an earthy clay, and would not, as a rule, be durable. Then take one brick and hit it a hard blow with a trowel, when it should break fairly and squarely into two parts, and not crumble or chip.

The durability of most bricks will depend in a measure upon the degree to which they are absorbent. Underburnt bricks absorb more than those of the same variety which are well burnt, and among those of different varieties, those absorbing the most water are, almost without exception, the least durable. A test for this quality of absorption will be valuable. Immerse a sample brick in water for about two hours. Then compare the weight of the brick before and after immersion, when it should not have absorbed more water than an amount equal to one-third its weight. As further tests, it should be seen that the bricks are uniform and close—almost pasty—in texture, free from stones and pieces of foreign matter, and are of good shape, with the sides perfectly parallel and the angles clear and sharp. A heavy brick of close and uniform texture will, as a rule, be found stronger and more durable than a lighter brick.

The various varieties of bricks differ in size to a considerable extent; thus the Philadelphia brick is $8\frac{1}{4} \times 4\frac{1}{8} \times 2\frac{3}{8}$ in., the Maine $7\frac{1}{2} \times 3\frac{3}{8} \times 2\frac{3}{8}$ in., and the North River brick, employed so largely in New York and its vicinity, is $8 \times 3\frac{1}{2} \times 2\frac{1}{4}$ in. Although this difference of dimensions in the various varieties is productive of a certain amount of inconvenience, it is not of very great moment. It is, however, of considerable importance that the brick of the same variety shall be of the same size. In the manufacture of bricks, the moulds, after being some time in use, are often considerably worn down, with the result that the bricks are turned out in varying sizes from the different machines, being larger or smaller, according to whether they have old or new moulds on. This is objectionable, chiefly for the reason of the increased quantity of mortar it gives rise to in the walls, which are set out to accommodate the largest sized bricks.

The above mentioned tests are those which a good brick would generally pass through, but a brick should not necessarily be rejected because it failed in any one of them. Thus a brick of the class used for facing would be expected to bear all the tests better than an ordinary "rough" building brick. Considerable judgment is required to determine how far these tests should be enforced, and it is clear that a different standard of excellence must be taken with the two varieties. Certain descriptions of brick will be found to fail in one test while they pass all the others. Some clays and clay earths yield a brick of so bad a color (sometimes in varying blotches, and in others of an insipid pale tint) that it would be unfit for outside work. Many of the bricks of this description are quite sound, hard, and durable, and could be used with advantage for inside positions where they would not be exposed to view.

Perhaps the best and most important test of a brick is its strength. Bricks, unlike stones, are comparatively little influenced by the gases and acids in the atmosphere, and the qualities of strength and durability in the material are therefore closely connected. Many experiments have been made from time to time to ascertain the strength of bricks. In a series of very careful tests made some six years since on over 1,600 different specimens, it was found that common brick crushed with weights varying from 697 to 3,200 pounds per square inch, the brick of average quality crushing with a weight of 2,175 pounds. Hard burnt facing bricks crushed at a pressure of 1,536 pounds to 4,395 pounds, with an average of 2,760 pounds per square inch. These results show figures higher than would be obtained from many varieties of bricks now in common use, although in some varieties, such as the blue bricks, the results would exceed those given. Generally speaking, a rough brick should withstand a pressure of at least 1,000 pounds per square in., and a facing brick 1,800 pounds per square inch, to fit it for its purpose, and, as has already been remarked, it will probably be much more durable, the greater strength it possesses. A rough brick which crushed with a weight less than 1,000 pounds per square inch could be used in unimportant positions, but it would not be suitable for good walling.

As a rule, it is not difficult to devise a simple apparatus to test the strength of bricks, the only testing strain required being a direct crushing one. A whole brick should be experimented upon, and a note made when it became cracked and when finally crushed. In dealing with a new variety of brick, it is often convenient to test another of well known and undoubted qualities at the same time, for the purpose of comparison. Where bricks are to be exclusively employed, it would be advisable, for the greater assurance of accuracy, to have one or more specimen bricks tested by a proper testing machine. Many of the large firms of engineers throughout the country possess such machines, and in many of our more important cities there are regular testing establishments, where specimens will be properly tested on payment of a small fee.

Cheap Hydrogen Gas.

A novel method, invented by MM. Felix Hembert and Henry, of manufacturing hydrogen gas on a large scale, has been briefly described by them in a communication to the French Academy of Sciences. In a retort, superheated steam in fine jets is passed over coke in the state of incandescence. The gas mixture generated, which consists of equal volumes of hydrogen and carbonic oxide, is made to circulate in a second retort, also heated to a red glow, containing obstacles of a refractory material, so that the gases are well mixed and heated. At the same time, more steam heated to the point of dissociation is admitted into this retort. The theory requires an excess of water vapor to insure the complete oxidation of carbonic oxide, the gases decomposed forming carbonic acid (carbon dioxide) and hydrogen gas. It is claimed that 3,200 cubic meters of hydrogen gas can be obtained per ton of coke, at a cost of 0·015 franc per cubic meter, equivalent to approximately one-tenth of a penny per cubic yard. When M. Fages first made hydrogen out of coal and water, he could furnish hydrogen gas at 0·044 franc a cubic meter.

An Aerolite in Cuban Skies.

A correspondent in Havana writes to us that at 7:40 P.M. on the 10th of May, the sky was illuminated by an aerolite of great magnitude. It appeared first as a single luminous point, and traveled from the northwest to the southeast. When crossing the zenith, its size appeared about equal to that of the moon. It left behind a track of white and blue light. The nucleus was of a fiery red color. While still some distance above the horizon, the meteor burst into small fragments, resembling the sparks from a sky rocket. These took different directions, becoming invisible a moment or so afterward.

Plastic Decorations.

The Plastic Decoration and Papier Mache Co., of Wellington st., Strand, London, have lately opened new and extensive workshops in Market road, Caledonian road, N., where they are carrying on some interesting work in the above description of materials. Here may be seen, not only fibrous plaster carton pierre, but papier mache decoration in process of manufacture in all their varied applications.

We have more than once spoken of the value of substituting for the fabrications in common lath and plaster—often of the most commonplace and vulgar kind—the superior fibrous material and papier mache decorations, which are not only more tenacious and durable, but admit of easy fixing, without dirt and delay, by screws to the wood joists. The Papier Mache Company have lately prepared for Sydney, New South Wales, the decorations of Her Majesty's Theater, a building of recent construction. These have been executed in fibrous plaster, and include the flat domed ornamental ceiling, the capitals and enrichments of the columns, the fronts of three tiers of boxes, modeled with figures in relief, and a very elaborate vestibule decoration. The new Pavilion Music Hall in Piccadilly has also been decorated with the same material with highly satisfactory results. Fibrous plaster, which, as most of our readers are aware, consists of a thin layer of plaster of Paris on a canvas backing stretched to a light framework of laths, has the great advantage of being readily put up for ceilings; it is extremely light, and can be fixed in slab or pieces at convenient joints. Papier mache is more durable and suitable material for smaller ornaments, and has largely taken the place of composition or plaster.

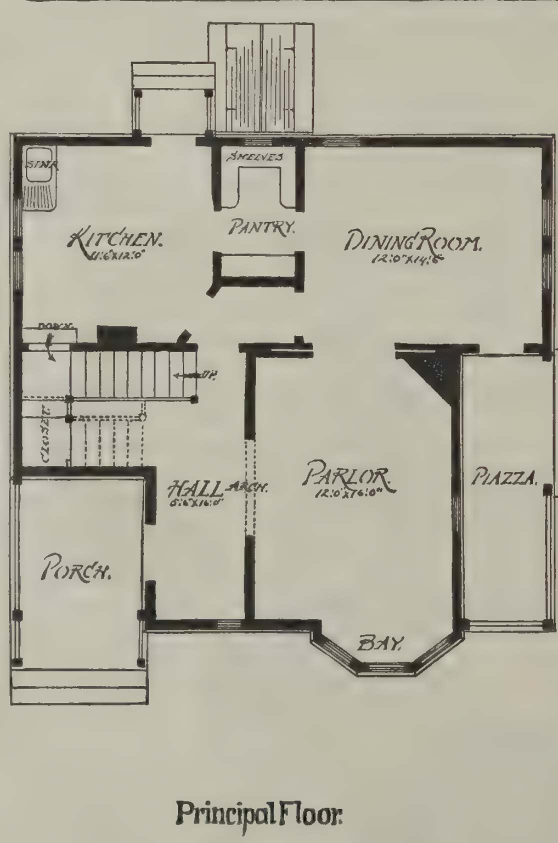
In the company's works we notice both materials and carton pierre—another kind of papier mache—being made. A large screw press is employed, with steel disks, by which the pulp is moulded into the required shape. A great deal of trimming and hand work are required to complete the ornament. An extensive assortment of metal dies many tons in weight, some of brass and type metal, are employed, and by these means a never failing variety of design can be insured. The manufactures of the Plastic Decoration and Papier Mache Company are too numerous to mention in a brief description. Ceilings, cornices, centers, columns, capitals, panels, trusses, pilasters, friezes, are a few of the ordinary kinds of work turned out by this company. Papier mache center flowers, some of which are bronzed, as in one order for Melbourne, are manufactured in large variety of designs; these are light, and put together on a wire or lath frame, so that they can be quickly fixed. This material can now be made impervious to moisture, so as to make it suitable for out of door use. For capitals to columns and small ornaments to woodwork or furniture, no lighter or better material than papier mache can be obtained.

A very considerable development of the Louis XV. and Louis XVI. styles of ornamentation must be attributed to the use of plastic materials, such as fibrous plaster. We notice that the company are engaged in several important works in which this free style of ornamentation is employed. Not only for the mere constructive features of columns and pilasters, but for decorative ceilings, friezes, coves, cornices, and over doors, the fibrous plaster is specially suited, being at once light and easily moulded to any curve. We notice several very elaborate designs for ceilings and coves, for which gelatine moulds are used, besides fluted pilasters, a handsome box front for the Sydney Theater enriched by relief figures, and some very elegantly designed surface ornament of the Louis Seize period.—*Building News.*

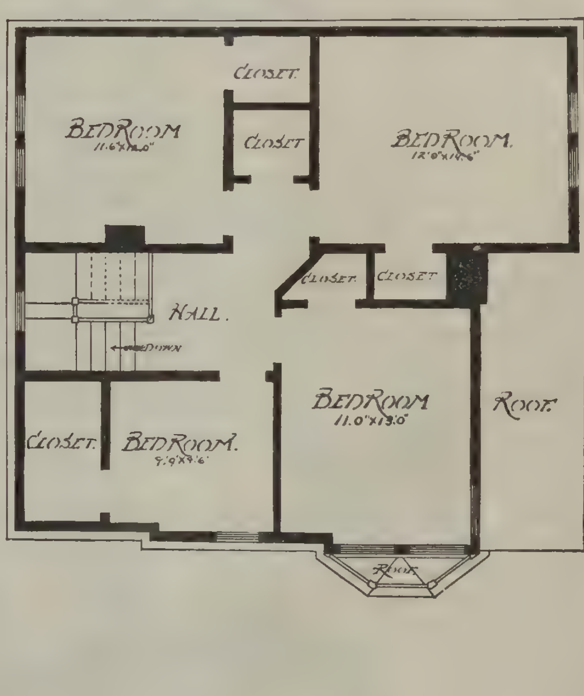
A COTTAGE AT LITTLE FALLS.

The perspective sketch and plans represent a house built at Little Falls, N. Y., under the superintendence of the architects, Messrs. Fuller & Wheeler, of 86 State St., Albany, N. Y. The cost was $3,500, the materials being good and the construction substantial. The first floor is clapboarded, and the second story and roof are shingled. A good finished room in the attic and a large dry cellar are provided in addition to the accommodation shown upon the plans.

Hardwood trim is used in the principal rooms, and the house is tastefully painted and thoroughly heated and drained throughout. The drawings are taken, by permission, from "Artistic Homes," by R. W. Fuller.



Principal Floor.



Second Floor.

A COTTAGE AT LITTLE FALLS, N. Y.

Country Home Adornment.

Nothing in a country landscape shows so much the taste of the inhabitants as the adornment—or the lack—displayed in the surroundings of the homestead. A friend once said to me in passing two houses of very opposite appearance, that she did not need to go inside to tell the character of the inmates, and her judgment was correct. The household makes the home what it is, and its influence is forever stamped upon those who live by the hearthstone, and will live in the memory of the children through all their lives. The adornment of a country home by planting trees, shrubs, and fruit trees, by keeping a well cut greensward, and flowering vines and plants, can never be overestimated. But it must be done with system and with a view to what the result will be when they have grown larger.

I know a cottage where one fine spring the owner planted a row of mountain ash close to the parlor windows. In a few years they grew so strong and dense as to overshadow the house, the branches tapping on the panes of glass at the bed-room windows, and last year he cut them all down, and the house stands now bare and unshaded. If these trees had been planted outside the sidewalk, they would still have been near enough to the house, and a shade to every passer-by. Nothing gives a better tone to the appearance of a country home than a well-kept lawn, but it needs persistent effort, a good lawn mower, and the will to work it. Boys, as a rule, object to the lawn mowing as much as a dog does to churning, and generally have a dozen other things on hand if wanted for that purpose. But if the lawn is not too large, and there is a promise of regular, if small, remuneration every time the implement is used, and the boy's pride in the neatness of the homestead is aroused, it is very likely there will not be any difficulty. There should, if possible, be a little slope, as flatness is always uninteresting, and shrubs that flower at various seasons can add great beauty at little cost. It is not always money that adds all the charm and grace to adorn the home. It is the individuality of the inhabitants impressed by their work upon the land, as the brush of an artist gives character to the picture he paints.

The home exerts an influence for good or evil upon the young and in after years children will remember the time spent there as the brightest or the darkest years of their lives. How important, then, to make the surroundings pleasant! And if they are taught to help to plant the grounds, to tend the garden, and to plan for the home improvement, they will have an added interest in it.

"This is the tree I helped papa plant on Nellie's birthday," "That is the vine we put in when Harry was ten years old," are landmarks in a life history that live to its latest page.

I know an orchard, too, that was planted by the growing boys and girls at a time when help could not be procured, and they take greater pride in it than in any of the older orchards that were planted by hirelings. It is something tangible as a result of their work. So let the children be taught to embellish the home, to learn the art of adornment, to keep neat fences, tidy dooryards, to avoid throwing rubbish about, or allowing unsightly objects to be about the premises. It is just as easy as the other way, and forms habits of tidiness and thrift that will be a lesson well learned. Not those homes where the most money is spent, but those where the most good taste is displayed are best, and the owner is repaid for every hour spent on beautifying improvements.—*Our Country Home.*

Suburban Schools.

Warren R. Briggs, architect, in a series of able articles on "The Plan and Construction of School Houses," published in *Building*, makes the following righteous comments:

"The sanitary arrangements of village and suburban school houses are, with a few exceptions, of the most objectionable nature. A carelessly constructed privy, situated at some distance in the rear of the school house, is the usual accommodation offered. The majority of those that I have examined have been so poorly built, or were in such a dilapidated condition, as to be almost untenable in cold and stormy weather, even for the short time required for the calls of nature. These miserable shanties, devoid of the simplest comforts, besmeared with nastiness, adorned with obscene scrawls, cannot but be injurious to the morals of children. No parents, could they see these places, would wish to have a carefully reared child frequent them; but there is no alternative. No matter how repugnant to delicate sensibilities these teeming monuments of filth may be, children are forced to use them day after day, and it is no wonder that their finer instincts are blunted, their modesty corrupted, and the seeds of sensuality and vulgarity are sown.

"In all seasons and in all weather a child leaves the school room and crosses the play ground to these privies. In winter, when the school room is at a temperature of about 70° or more, the sudden change from a warm room to a cold outbuilding is enough in itself to be dangerous to the strongest and most robust, and yet thousands upon thousands of children are every day during the winter subjected to this exposure. In warmer weather the conditions are not much better, for, while the frosts of winter are almost unbearable, they still have the power, by freezing, of reducing the stench so that it is not particularly objectionable; under the stimulating influence of heat, these beds of pollution are worse in many cases than the foulest pig sties.

"Reader, do you think that this picture is overdrawn, or that the statements here made cannot be substantiated? If you do, will you take the trouble to investigate for yourself? Let no false modesty deter you, but go to these places, examine them carefully, and, without prejudice, judge for yourself whether or no the evils which I have depicted exist.

"It will probably be said that many of these things are bound to occur where there is a promiscuous gathering of children. This I do not believe. I am convinced that, under proper management, carefully constructed, conveniently located, well heated and ventilated rooms, in which are placed the required number of water closets and urinals, can be built, which will be in no way objectionable.

"The first step toward a radical reform must be to abolish the privy forever; nothing can be more dangerous to health. Apparently, the only reason for its maintenance is the cheapness of its construction and its ability to take care of itself, little or no attention being given to a privy after it is once finished.

"I would that it should become a law that no school building should have a privy vault connected with it. It will be asked, What can be done in small towns or villages where there is no water or sewerage system?

"There are two ways open for overcoming this obstacle. The first, and probably the cheapest, is by what are known as 'earth closets.'

"The several ways in which these may be used have been so fully described by able writers that it is not necessary for me to go into it here. The second method, and the one that I have usually employed, is the use of the water closet. Any good closet may be used—the simpler the mechanism, the better. Those known as tank closets are the best for the purpose. These are fed from a tank placed over the closets, to which are attached service boxes—one for each closet. Water can be supplied to this tank from a larger tank in the attic, which is in turn supplied with water pumped into it either from a cistern or a well. It is folly to say that this is impracticable, or that sufficient water cannot be obtained to properly supply the closets; it has been repeatedly demonstrated that water enough can be obtained; the question is only one of storage capacity.

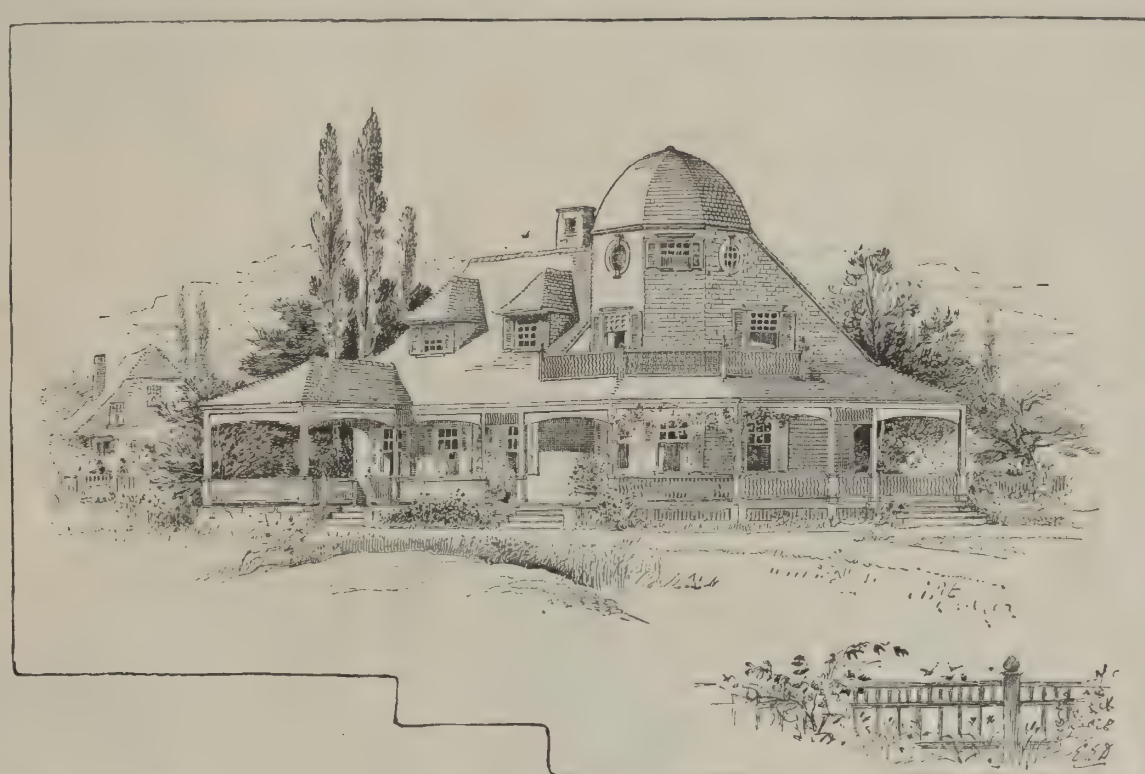
"Enough water can be collected from the roof of any ordinary school house and stored in cisterns to supply the closets and urinals for from two to three weeks. At the time of year when droughts are likely to occur the schools are closed; but should the cistern supply be exhausted, a two-way pump, pumping either from the well or cistern, would insure a supply from the well. From ten to fifteen minutes' pumping, each day, would be all that would be necessary to keep the tanks full; so with a good force pump placed in the basement, an ample storage cistern, proper gutters with suitable leaders, an ample supply of water can be obtained. With this there can be no question but that the properly constructed water closet is the best known method for the removal of excreta."

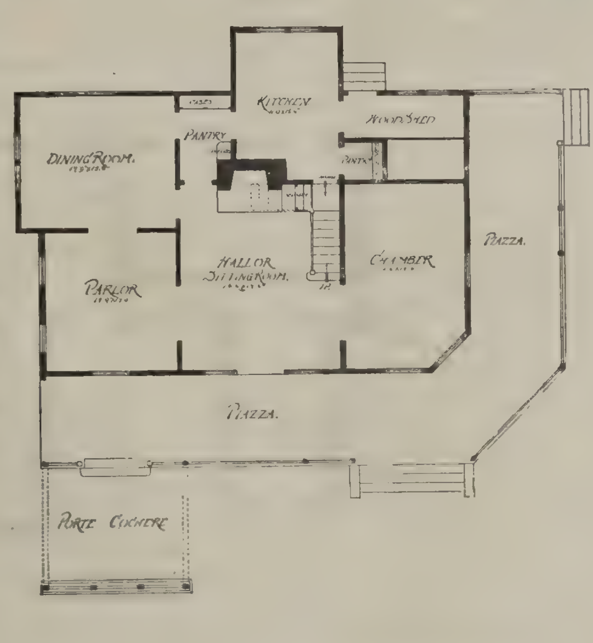
Inlaying by Electricity.

A method of damascening metals by electrolysis has been brought out in France. Two copper plates are put into a bath of sulphate of copper solution, one being connected with the positive pole and the other with the negative pole of a battery. A thin layer of insulating varnish or wax is spread over one of the copper plates, viz., that connected to the positive pole, and the damascened device is etched on it. Now, since copper is by electrolysis transferred from this plate to the other plate, it follows that only the lines of the drawing can be attacked. A battery of two cells is sufficient for this purpose. When the plate has been bitten to the depth of a millimeter, it is removed from the bath and treated with hydrochloric acid to remove traces of oxide of copper in the lines of the drawing. It is then washed with water and suspended in a bath of nickel and silver, and connected with the negative pole of the battery. The positive pole now consists of a plate of platinum. The silver or nickel deposits wherever the copper has been attacked, and the depressions are soon filled with the foreign metal. The plate is then polished, and looks like one which has been damascened by hand.

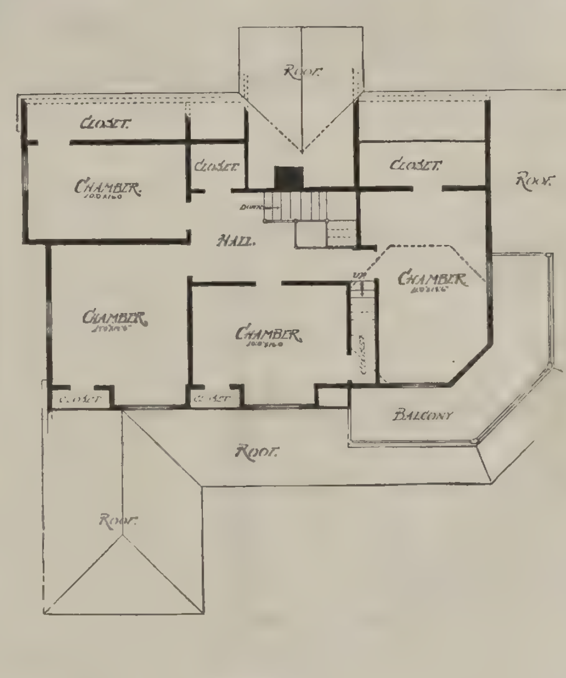
DESIGN FOR GEN. GRANT'S COTTAGE.

The cottage illustrated in the artistic little sketch annexed was designed by Mr. Albert W. Fuller, architect, of Albany, N. Y., for Gen. Grant's sojourn at Mt. McGregor. It was not, however, completed in time for his removal there. The design, which we take from the architect's book, "Artistic Homes," is of a somewhat novel and picturesque type, and is very characteristic of Mr. Fuller's work, especially in the feature of the octagonal tower. As a whole, it has a quaint and comfortable look, pleasing to almost every one. The estimate of the contractor for the erection of the house was $2,600.





Principal Floor.



Second Floor.

COTTAGE DESIGNED FOR GEN. GRANT.

Tenacity of Standard Gold.

In the annual report of the British Mint, it is stated that it is well known that standard gold is rendered very brittle and unfit for coinage by the addition of a minute quantity of certain metals, the action of lead being specially remarkable. It seemed desirable to obtain more accurate data than at present exist as to the effect of impurities on the mechanical properties of gold. With this object in view, bars five inches long, each weighing about five ounces, were prepared of pure gold, alloyed with pure copper in the proportion of the legal standard, as well as bars of the same alloy to which small but varying amounts of lead had been added. These bars were then cut by a planing machine into the form usually employed for testing the tenacity of metals, and submitted to traction in an ordinary testing machine.

The result showed that pure standard gold has a tensile strength of 18 tons per square inch sectional area. The limit of elasticity appears to be reached with a stress of 1¾ tons, and the sample of metal fractures after elongating 24 per cent. The presence of one four-thousandth part of lead reduces the tenacity to 7·7 tons, the limit of elasticity practically coincides with the breaking load, and the elongation is hardly measurable. The further addition of one four-thousandth part of lead produces a diminution of tenacity to 5·4 tons. If, however, the total amount of lead be raised to 1 per cent, the breaking point remains about the same, so that 0·5 per cent of lead would appear to be as deleterious as 1 per cent. The effect on the mechanical properties of standard gold produced by minute quantities of impurity is very remarkable, and well deserves further examination.

THE month of May, 1886, will be memorable in the railway annals of this country for the remarkable feat of gauge changing on the Southern railways, being the alteration of the gauge of 9,000 miles of road and 15,000 miles of "trackage" to the standard gauge from the somewhat wider one on which the lines were previously laid. This extraordinary piece of work was taken in hand by 10,000 men at midnight on Saturday, May 29, and completed by Monday evening, a uniform gauge throughout the States being thus secured.

Warming and Ventilation of School Rooms.

The question of heating and ventilating public buildings, including school houses, is becoming one of great importance, and much valuable time and thought are being devoted to this branch of study by the master minds of the country. The general health of the pupils of a school is almost entirely controlled by these two great factors. When pupils in a school room are engaged at study for, say, six hours a day in an improperly ventilated room for a period of months or years, the general health of the adult population of the nation is affected in the largest degree imaginable by such a condition of affairs. Bad health, contracted from these causes in youth, can scarcely ever be eradicated in the adult, and in consequence we have a weak, sickly population directly traceable to these causes. It is not putting it too strong to say that one-third of the public buildings in this country are but "death traps," and the bait nibbled at by the unsuspecting victim is defective heating and ventilation. In the construction of school houses, trustees should see to it that these two great factors are considered with proper regard by the architect or builder employed by them. A few salient suggestions in this connection will not be amiss. For purposes of ventilation, the height of the school room must bear the proper relation to its size. Adequate movements in the currents of air cannot be secured in a room unless the height be in proportion to the width and length. The minimum height must be fixed with reference to that which allow the currents of air to circulate without being inconvenient to the occupants. Therefore, in proportion as the width and length of the room be increased, the height must be also increased. On this account it is not advisable to make any room, no matter how small, less than ten feet high, and increase proportionately as the size increases. With large rooms, as the height should be increased in proportion to the size, if the cubic space be the measure of the number of occupants, the area or floor space per occupant would diminish with the size of the room. As, therefore, the height of rooms is necessarily variable, it follows that it is rather the floor space which must be considered in allotting accommodations to the occupants of a room than the cubic space.

As a general rule, a room ten feet square, or ten feet by twelve feet in area, should not contain more than two persons. In school rooms, which are only occupied during parts of a day, and where the air can be changed between the periods of occupation, a less amount would suffice, and from fifteen to twenty square feet is sufficient.

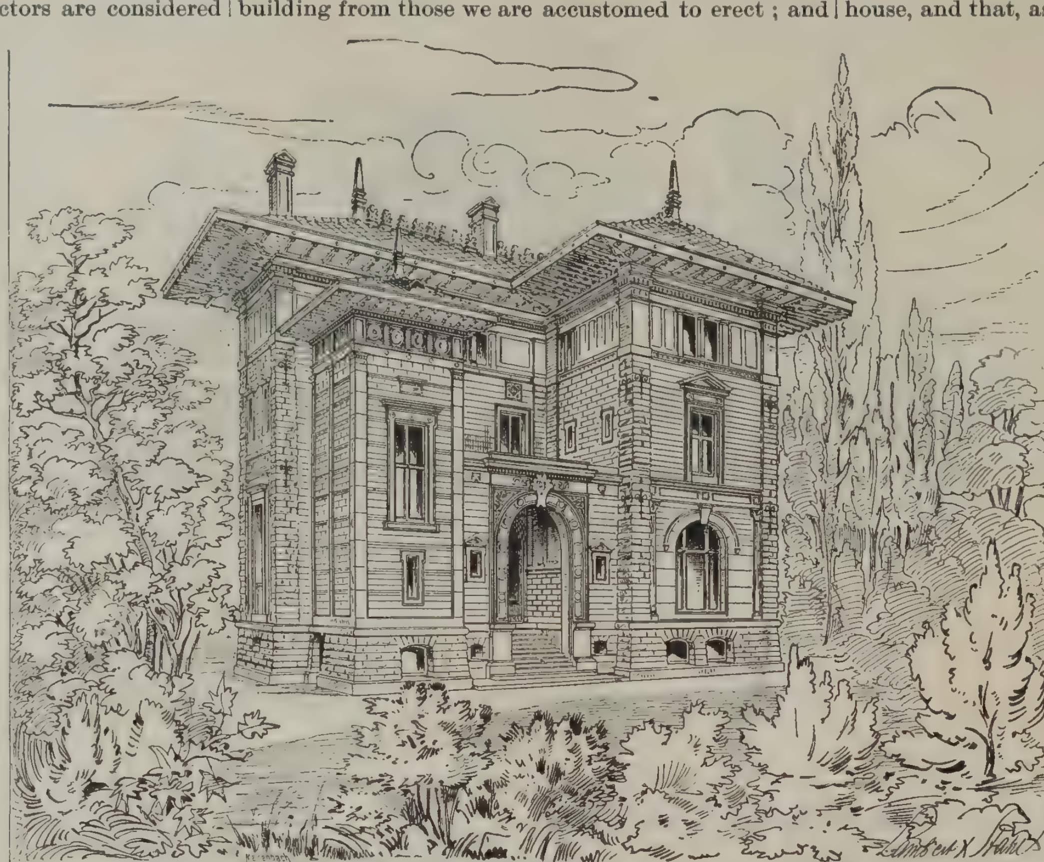
Nor should the ceilings of the rooms be too high, but just in proportion to the size of the room, as rooms with low ceilings are more readily and completely ventilated than those having ceilings too high and out of proportion to the size of the room. The leakage of air which is always going on keeps all parts of air in motion in such rooms, whereas, if the ceiling is higher, only the lower part of the air is moved, and an inverted lake of foul and hot air is left floating in the space above the window tops. To have the currents of fresh air circulating only in the lower parts of the room, while the upper portion of the air is left unaffected, is really the worst way of ventilating; for the stagnant atmospheric lake under the ceiling, although motionless, keeps actively at work under the law of the diffusion of gases, fouling the fresh currents circulating beneath it. With low ceilings and high windows no such accumulation of air is possible, for the whole height of the room is swept by the currents as the dust of the floor is swept with a broom. Low ceilings have also the advantage of enabling the room to be warmed with less expenditure of heat and less cost for fuel.—*Trustees' Trade Journal.*

A FRENCH COTTAGE.

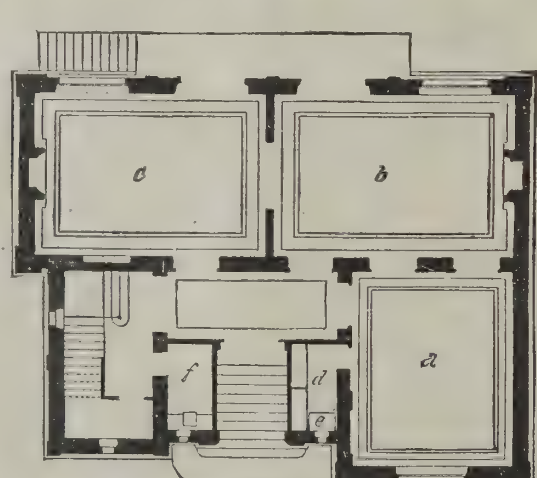
We give herewith, by way of illustrating the differences in national tastes as respects cottage architecture, the elevation and plans of a recently built French cottage of moderate cost, by Paul Bouvier, a well-known French architect. This dwelling has been erected near Paris.

To the matter of fact American eye, it is doubtful if this style of structure will be found specially desirable or attractive. It is certainly a very different type of building from those we are accustomed to erect; and if we do not appreciate it, if it looks stilted, and conveys to us little idea of beauty, or appears to be wanting in adaptability to the requirements of home life, the fault may be with us.

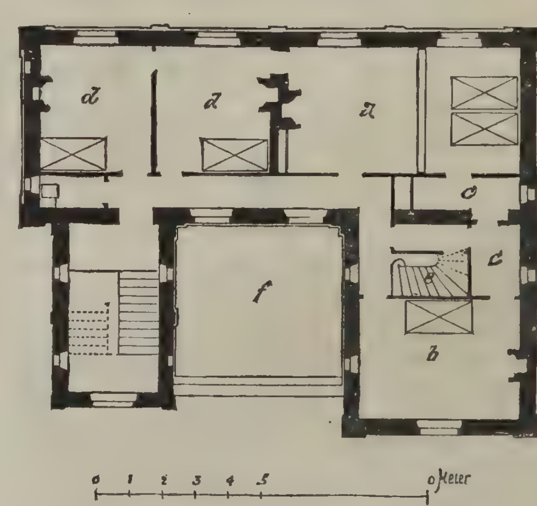
The French are proverbial for cultivated taste and superior skill in designing. Perhaps it is our lack of culture that renders us unable to perceive any peculiar excellence in this example. Some of our readers, after due consideration, may be able to discover the way to its attractions. At any rate, it will illustrate to them a French idea of a country house.



FIRST FLOOR.
a, Dining room.
b, Drawing room.
c, Billiard room.
d, Butler's pantry.
e, Dumb-waiter.
f, Closet.



SECOND FLOOR.
a, Sleeping room.
b, Sleeping room.
c, Toilet.
d, Sleeping room.
e, Stairs.
f, Balcony.



A FRENCH COTTAGE.—PAUL BOUVIER, ARCHITECT.

Thermometers for White Heat.

Heisch & Folkard, of London, have devised some new thermometers, with platinum or porcelain bulbs, by which very high temperatures, even those of a white heat, can be measured without having to resort to an expensive or troublesome pyrometer. The reading is taken in precisely the same way as at present with an ordinary thermometer, but the result is obtained by the pressure of air inclosed in the bulb, which is exposed to the heat. This pressure acts directly on a vertical column of mercury. The bulb is hermetically sealed, and the instrument is unaffected by changes in the height of the barometer.

A Warm Controversey.

A rather interesting point was recently decided by the Massachusetts Supreme Court, on appeal from the court below. A furnace manufacturer placed two furnaces in a house under a stipulation which is becoming rather common in certain kinds of business, that they should remain the property of the dealer until paid for.

The owner of the house in which the furnaces were set sold the house to a Mr. Way, without mentioning the fact that the furnaces did not belong to him, and the furnace man brought suit against the new owner to recover either the furnaces, with the pipes and registers connected with them, or their value. The lower court ordered judgment for the defendant, on the ground that the furnaces were a part of the house, and passed with it to an innocent purchaser without regard to an agreement respecting them of which he was ignorant. The furnace maker appealed, claiming that Mr. Way might have found out by inquiry that the furnaces did not belong to the former owner of the house, and that, as he neglected to make any inquiries on the subject, he was legally "affected with notice" of the fact which he might have learned.

The full bench of the Supreme Court was called upon to consider the question, and decided that it "could not properly rule" that as the defendant made no inquiries he was affected with notice of what he might have found on inquiry, that the furnaces were the property of the plaintiff; and it further decided that it was "quite clear" that the furnaces and pipes claimed in the plaintiff's writ, which were put in as part of the house, and were essential to the enjoyment and use of it as a dwelling house, were "annexed to and became a part of the realty, and passed to the defendant by his deed." The fact that there was an agreement between the former owner and the plaintiff, that the furnaces should remain the property of the plaintiff until paid for, was "immaterial unless the defendant had notice of such agreement, and notwithstanding such agreement, the property annexed to the realty would pass to an innocent purchaser without notice."

Bursting of Centrifugal Cream Separators.

The *Dairy World* says: On the 12th of April, at Mr. Horton Gillis' Big Foot creamery, near Harvard, Ill., one of the above machines, made in Philadelphia, while supposed to be running at the rate of about 3,500 revolutions a minute, suddenly exploded, pieces of the steel cylinder and heavy cast iron casement flying in all directions. One man, Z. Petersen, was killed, and five others injured, one fatally. The coroner's jury, in their verdict, stated that the machine was "imperfectly constructed." Subsequent investigation seems to show that the man who put up the machine, in calculating the size of the pulleys, had asked the engine driver what the speed of the main shaft was, and was told something lower than was actually the case; hence the machine is said to have been running 5,000 revolutions instead of 3,500, at the time of the explosion. The welding of the steel, in this particular machine, was imperfect.

On April 15 the explosion of another cream separator occurred in W. H. Hintze's creamery at Burlington, Ill., by which the butter maker, O. S. Dunn, was killed.

THE BLAKE STEAM PUMPS AND PUMPING ENGINES.

The Geo. F. Blake Manufacturing Company, of New York and Boston, is the maker of a line of steam pumps and pumping engines more extensive, probably, than that of any other concern in the country.

The Blake pumps have been adopted by several of the largest firms engaged in the manufacture of steam engines and steamships. They are also used by the navy departments of the United States, England, and

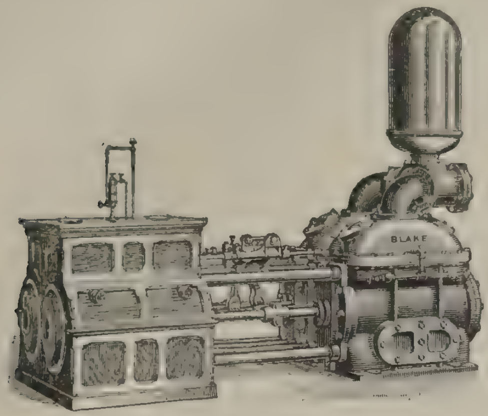


Fig. 1.—THE BLAKE IMPROVED DUPLEX PUMP.

Russia, in the water works of a number of towns and cities, in some of the largest coal and iron mines, and on the pipe lines in the oil regions of both America and Russia. As pumping is an operation entering into almost every one of our manifold industries, the subject of pumps and pumping engines possesses a general interest that will probably make a brief description and several illustrations of improved pumps acceptable to a majority of our readers.

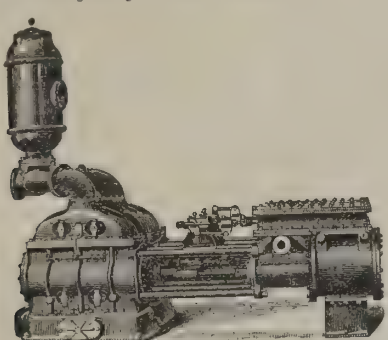


Fig. 2.—THE BLAKE COMPOUND DUPLEX PUMPING ENGINE.

The Blake Steam Pump is positive in its action, that is to say, its operation at the slowest speed and under any pressure is perfectly continuous, and the pump is never liable to stop as the main valve passes its center. In the duplex pump, shown in Fig. 1, the pump ends and trimmings are all independent castings, and of heavy construction. It is an engine particularly designed for high pressure service, such as is required in water works and large manufacturing

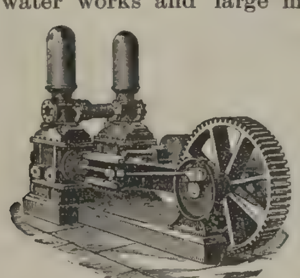


Fig. 3.—THE BLAKE DUPLEX GEARED POWER PUMP.

establishments. The pump ends are of the inside plunger type, and the plungers work through heavy composition sleeves grooved or packed with fibrous materials, as the nature of the fluid to be transported may necessitate. The valve mechanism is the same as that used in the larger compound engines. The capacity of these pumps ranges from five inch plungers upward. The smaller sizes are used in many apartment houses and other large buildings, for operating hydraulic elevators and for general pumping.

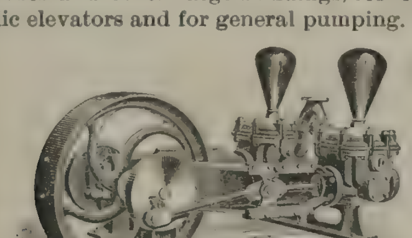


Fig. 4.—THE BLAKE POWER PUMP WITH PULLEY.

The compound duplex condensing pumping engine, shown in Fig. 2, is similar in detail and strength of parts to the construction of the simple engine, and is particularly designed to effect a strict economy in the combustion of fuel. These pumps are considerably less expensive in first cost than any form of rotative or Cornish pumping engines in use, and have the further advantage of requiring less attention and repairs. A condensing apparatus, consisting of an independent air pump and condenser, is frequently employed in connection with this type of engine, and adds considerably to the economy of its operation. The improved duplex geared power pump, shown in Fig. 3, has been designed for locations which require a large amount of water, and where the source of power is derived from a water-wheel rather than from steam. In this pump, as indeed in all the duplex forms, the cranks are set at right angles, thus bringing one pump to the middle of the stroke while the other is at the end. This arrangement insures a constant flow of water with the least variation of pressure. It also avoids all shock and jar when pumping. These power pumps have been in successful use in supplying water under pressure for hydraulic mining and for the water supply of villages. They are constructed with special reference to withstanding heavy strains, and are made either of the inside plunger or piston pattern. In the duplex power pump, shown in Fig. 4, the gear wheel has been replaced by a heavy fly-wheel or pulley, constructed of sufficient width of face to be driven by a belt. Like the former pump, they are designed to be driven by any form of independent motive power that may be most convenient—water, steam, or gas. They are intended for a service where the pressure against which they are required to act is comparatively light. It is an advantageous feature of construction that their operation is quite noiseless.

As there are many localities in which both steam and pump must be provided, the combined boiler and pump shown in Fig. 5 has been designed to meet this want. In this, the pump is permanently fastened to

Fig. 5.—THE BLAKE COMBINED BOILER AND PUMP.

the base of the boiler, all the steam and exhaust connections are made, and nothing remains but to connect the suction and discharge pipes. By this combination the entire pumping plant can be placed at the water supply without the trouble or expense of long steam connections. The convenience of this arrangement makes it particularly useful for use at summer hotels or suburban residences.

A person of ordinary intelligence can be taught to manage the boiler and pump in a few hours' time. They are made of good materials, and guaranteed up to a hundred pounds pressure per square inch.

The Blake pumps have met with much success, and at the present time there are more than 20,000 of them in actual service. A very attractive catalogue has been issued by the company, and will be furnished on application to the New York office, 95 Liberty Street, or the Boston office, 44 Washington Street.

Electric Water Lights.

A very interesting application of the electric incandescent light to mining operations recently took place at Lord Vernon's Poynton and Worth Colliery, near Stockport. It appears that the lower pump rod of the main pumping shaft of the Lady Pit, by which the pits are drained, broke, leaving the bucket in the bottom some 600 feet below, and submerged in water. To remedy the rupture, divers were employed from the firm of Siebe, Gorman & Co., the well known submarine engineers of Westminster, and their operations were carried on by the light of a Siebe diver's electric lantern worked by Thame's primary battery. The barrel of the shaft was disjointed and pulled up, and the pump rod was repaired by this means. The Siebe lantern is a strong appliance, and weighs some 83 pounds out of water.

It consists of an iron cover permitting the conductors to pass inside to a cluster of four incandescent lamps, the light of which is reflected downward by a white reflector in the roof. A stout glass globe encircles these, and is protected from injury by iron prongs around it. Fifteen cells of Thame's primary battery were employed, and the total light obtained was about 80 candles, a luminous sphere of some 6 feet in radius being obtained under water. We may add that Mr. Thame has designed a small hand lamp supplied by four cells of his battery, within the lantern, which is now used in the ether chambers of brewers. It is of the utmost importance that this lamp should be safe and free from any liability to cause explosion of the ether. It is carried into the chamber by the operatives, and *Engineering* says that Colonel Majendie has expressed his approval of the lamp for use in gunpowder works and magazines.

Granite.

Writing on the strength of granite, James Gowans says: "Resistance of granite to pressure, too much dependence must not be placed on the results given in text books. Granite has a cleavage the same as sandstone, although this opinion would be condemned by the orthodox geologist, as it touches on the theory of granite being an igneous and not an aqueous rock. I mention this but to reiterate what I have before asserted as to sandstone—namely, that to use granite so as to get the greatest resistance to pressure, the stone should be used so that the force should be at right angles to the cleavage or bedway of the materials. Granite, like sandstone, laid upon its natural bed will increase in strength. If granite is fairly bedded on an equal and resisting foundation, no load can in ordinary circumstances crush it. It may be safe enough, in dealing with granite, to take from 684 to 848 tons per square foot as a fair test of its strength."

BARNS.

Mr. A. C. McCray, writing to *The Builder and Wood-Worker*, gives the accompanying scheme of barn

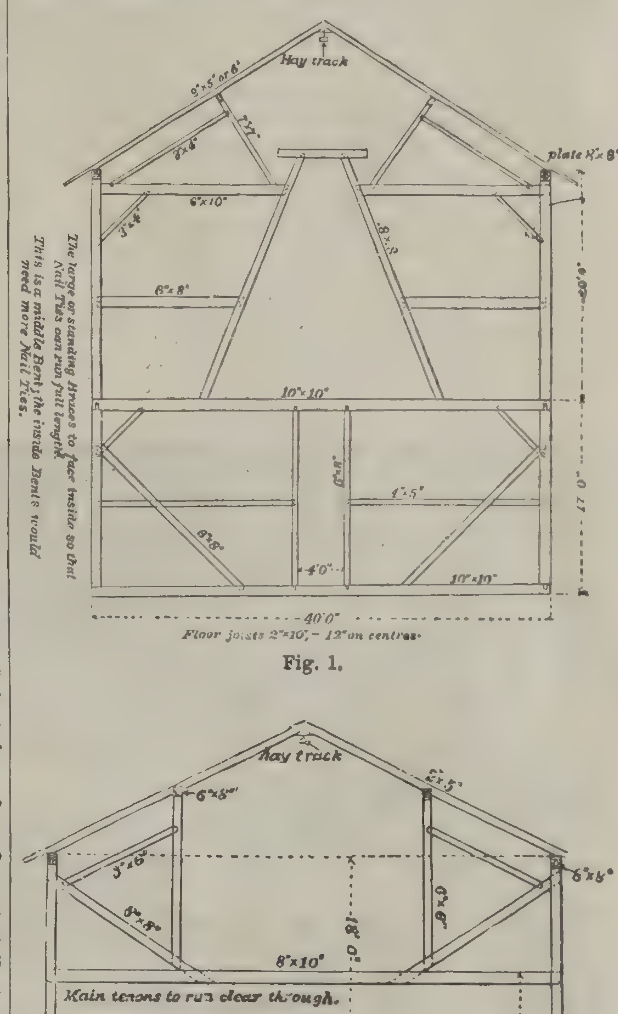


Fig. 1.

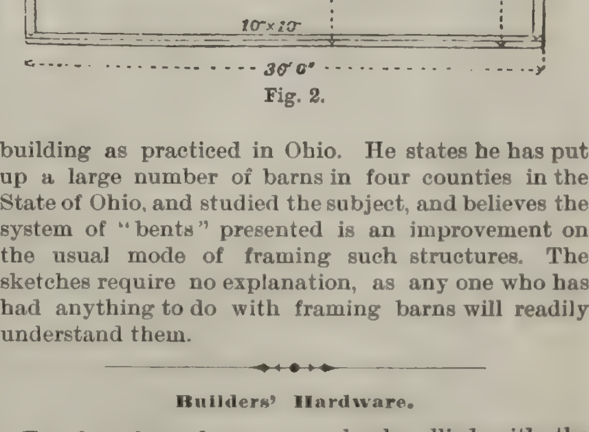


Fig. 2.

building as practiced in Ohio. He states he has put up a large number of barns in four counties in the State of Ohio, and studied the subject, and believes the system of "bents" presented is an improvement on the usual mode of framing such structures. The sketches require no explanation, as any one who has had anything to do with framing barns will readily understand them.

Builders' Hardware.

Few firms have been more closely allied with the building interests of Chicago since the great fire than that of Messrs. Orr & Lockett, of 184 and 186 Clark St., who have furnished the hardware for many of the most elegant public and private structures which now adorn that metropolis. They probably carry the largest stock in the Northwest, and it is particularly noticeable on account of the number of patented novelties which it contains. It has been the constant endeavor of the firm to add all new inventions of merit in the line of builders' hardware to their already large stock, and for this purpose they have acquired the exclusive agency for many of the best patents. As a result of their watchfulness, they have done much to improve the grade of building hardware, and have been rewarded by a large and steadily increasing business.

The Principle of a Lever.

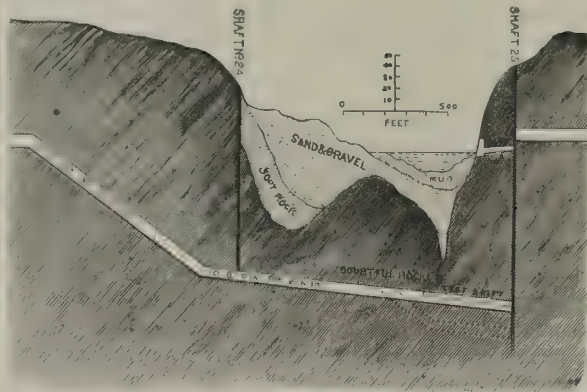
It is a very common belief that power is gained by some sort of mechanical device or contrivance, say lever for example. A man sees that if he has a lever, say three to one, he can move a great deal heavier weight with it than he can without the lever. He argues from this that he has increased his own strength in some mysterious way, or that a bar of wood or iron of a certain length has given him more power. This is manifestly absurd, but is believed by many to be a fact. No lever can give any power, neither can any mechanical device increase a man's strength. The work of a lever is reckoned by the space moved through by both ends of it, the hand end, so to call it, and the work end, and the time occupied in the operation. If a man has a lever three to one, that is three times longer on one end than it is on the other end, he moves, say, three times more weight than he could with his unaided force; but he moves it much slower, and his hand travels much farther with the lever than without it. In order to raise one hundred pounds three feet with his hand, he raises the one hundred pounds three feet at once, and does it, we may say, in one minute; but if he takes a lever, and raises say three hundred pounds three feet, the time will be threefold greater. This is the principle of a lever plainly stated, though not mathematically correct in the above case, which is for illustration only.

We have gained an apparent advantage in the lever because we have actually moved a weight with it we could not move without it. But we could have put up three hundred pounds in lots of one hundred pounds each to the same distance in the same time that we have put up three hundred pounds by the lever. There is, therefore, no increase of or gain in power by the use of a lever. It is a mechanical advantage paid for in time.—*Milling Engineer.*

THE NEW AQUEDUCT FOR NEW YORK.

In our issue for December, 1885, page 48, we gave some account of this great work, with illustrations, and we now continue the same. To builders and contractors this remarkable undertaking is especially interesting.

Perhaps the most interesting and novel feature of the great aqueduct now being built by the city of New York to increase its water supply is that portion of the tunnel extending beneath the Harlem River. The contrast between the old and new methods of crossing this river has been happily brought out by our artist in the engraving. High Bridge, over which the present supply comes, shows plainly in the background; the foreground being occupied by the section through the bed and banks of the river, far below the surface of which the new aqueduct is to pass.



LONGITUDINAL SECTION, AQUEDUCT UNDER HARLEM RIVER.

We here have, within a half mile, the two most wonderful examples of conducting water across a river—one forming the most conspicuous and attractive object in a naturally beautiful region; the other forming the safer conveyer, far beyond the reach of any efforts that might be made to destroy it, and as durable as the solid rock in which it is buried.

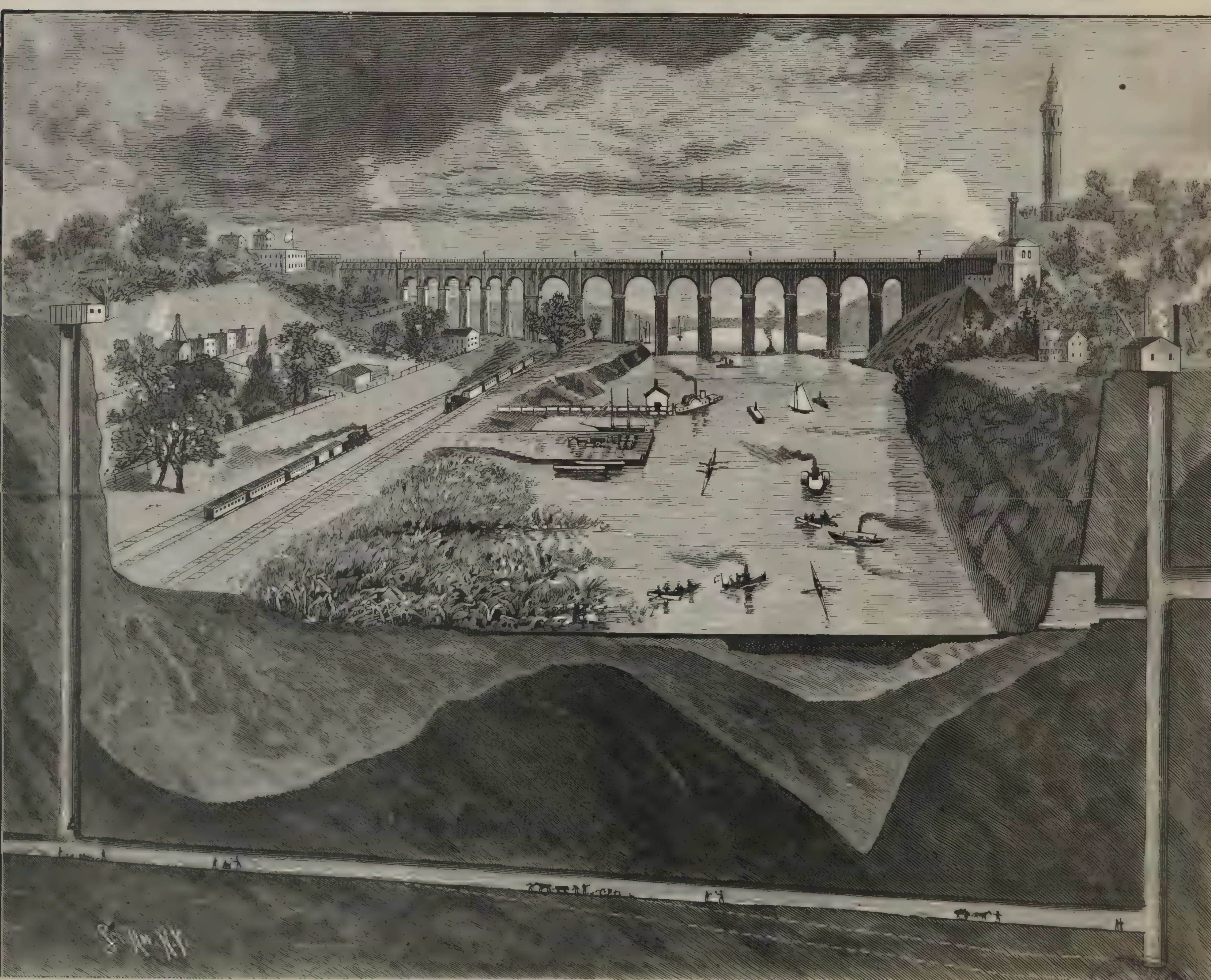
The bed of the river is composed of sand and gravel at the eastern side and mud at the western side; below these is hard rock, which takes the form, immediately under the mud, of a sort of deep, narrow valley, as shown in the accompanying longitudinal section. To clear this low spot, the aqueduct must be sunk at least 150 feet below the river water level, when the crossing can be made through solid rock. After reaching the bottom of shaft No. 25, during construction, a small test drift will be extended to the doubtful rock; if this shows hard rock, the tunnel will be erected as indicated by the full lines; but if it uncovers loose rock, the shaft will be further extended, and the tunnel built as indicated by the dotted lines.

Section 12 of the aqueduct extends from a point in the vicinity of shaft 24 (shown on a map published, together with a general description of the aqueduct, in the Scientific American of November 7, 1885) on the easterly side of the Harlem River across and under the river to a point near 178th street and Tenth avenue, a total distance of about 1,937 feet. A short distance east of the river the aqueduct is carried downward on a grade of 15 in the 100, the diameter being 12 feet 3 inches to a point just east of shaft 24; from here to shaft 25, on the opposite side of the Harlem, the grade is 2 in the 100, and the diameter 10 feet 6 inches.

The water on its way to the city will then flow up shaft 25 to a point above the surface of the river—at a level about equal to that of the aqueduct at the opposite side before it dips to pass under the bed of the river—and from thence through solid rock to a gate house at 135th street, between Convent and Tenth avenues, the diameter at the last mentioned portion being 12 ft. 3 in. This section of the aqueduct is to be lined with masonry throughout, and that portion below the river is to be lined with cast iron to prevent percolation. Where the aqueduct has a diameter of 12 ft 3 in., the cross section of the excavation is to be a circle 14 ft. 11 in. in diameter; where it is 10 ft. 6 in. in diameter, the circular section of the excavation is to be 13 ft. 10 in. in diameter. The test drift is to have a rectangular section 7 ft. wide by 6 ft. high, and the blow-off tunnel to be excavated between shaft 25 and the river, above high water mark, for the accommodation of two blow-off pipes, is to be 12 ft. wide by 6 ft. high. The lining is to be of brick, backed up with concrete and rubble stone, and all the masonry is to be laid in hydraulic cement mortar, all of which will be subjected to severe tests before being accepted. All the mortar is to consist of 1 part of cement to 2 parts of clean sharp sand, and the broken stone for the concrete is not to exceed 2 in. in greatest diameter.

The excavation for the double shaft 25 is to be 33 ft. wide, across the line of the aqueduct, by 16 ft. 6 in.

(*Continued on page 13.*)



THE NEW AQUEDUCT PASSING UNDER THE HARLEM RIVER, NEW YORK CITY.

George Westinghouse.

George Westinghouse owes his great and rapidly increasing wealth to his inventive genius. Twenty years ago he was a poor young man, but he struck it rich in his air brake for railroads, and money has since flowed into his coffers in a golden stream. He is one of the most prolific inventors of the age, and has enough good mechanical ideas to furnish every manufacturing establishment in Pittsburg with successful specialties. He is not only highly skilled in theoretical and practical mechanics, but is also a thorough electrician. He expends an ordinary fortune every year in experiments necessary to the perfection of his inventions. By warrant of the King of Belgium he is entitled to the title of Sir George Westinghouse, having been knighted by that monarch as a recognition of his services to the world as an inventor.

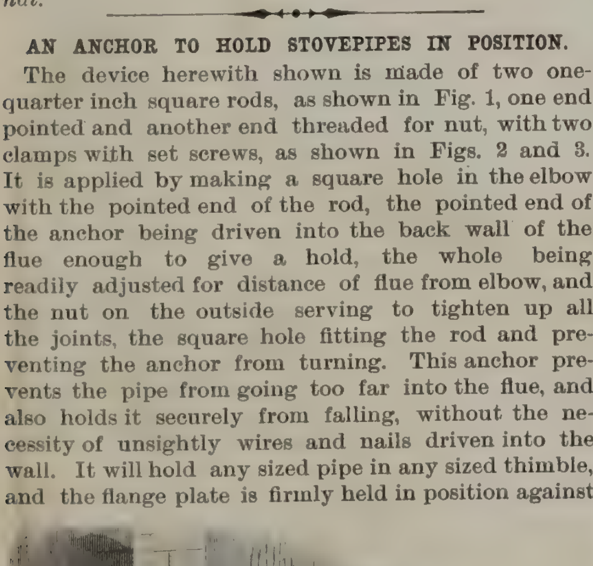
Gas Wells Fired by Lightning.

The burning of natural gas wells in Pennsylvania are sights as thrilling to the beholder as they are dangerous to adjacent property. We have given the particulars of these on various occasions. Recently one of these wells took fire, and a volume of flame shot up into the air for several hundred feet with a velocity that was astounding, showing that the pressure of gas from beneath was something beyond comprehension. This well burned for a long time in spite of all efforts to shut off the flame. It was finally done by means of a huge extinguisher, which was advanced slowly to the mouth of the well and then raised vertically, thus shutting off the air and smothering the flame.

A few days since, one of these wells was set on fire in a very curious manner. The workmen had drilled down until gas in small quantities was found to arise through the boring. A sudden storm came up, the atmosphere became thick and prevented the gas from rising freely. The workmen anticipated trouble, and hastily departed from the well. They had scarcely got to a safe distance when a flash of lightning ignited the gas in the atmosphere over the well; flames instantly communicated to the well itself, the result being that the gas in the lower regions was released, and shot upward with a terrific flame to a height of 200 feet or more. The well burned for several days, the column of flaming gas mounting into the air and lighting up the surrounding country for miles. Another well was struck at the same time in another section of the oil regions, and was burning for a long time, threatening adjacent property. Fires occurring in the products of the oil regions, whether gas or oil, are extremely difficult to extinguish, and the amount of property lost in consequence of them is immense.—*Fireman's Journal.*

AN ANCHOR TO HOLD STOVEPIPES IN POSITION.

The device herewith shown is made of two one-quarter inch square rods, as shown in Fig. 1, one end pointed and another end threaded for nut, with two clamps with set screws, as shown in Figs. 2 and 3. It is applied by making a square hole in the elbow with the pointed end of the rod, the pointed end of the anchor being driven into the back wall of the flue enough to give a hold, the whole being readily adjusted for distance of flue from elbow, and the nut on the outside serving to tighten up all the joints, the square hole fitting the rod and preventing the anchor from turning. This anchor prevents the pipe from going too far into the flue, and also holds it securely from falling, without the necessity of unsightly wires and nails driven into the wall. It will hold any sized pipe in any sized thimble, and the flange plate is firmly held in position against



TUCKFIELD'S STOVEPIPE ANCHOR.

the wall, to prevent air from drawing through and interfering with the draught.

This invention has been patented by Mr. Charles B. Tuckfield, of No. 533 First East Street, Salt Lake City, Utah.

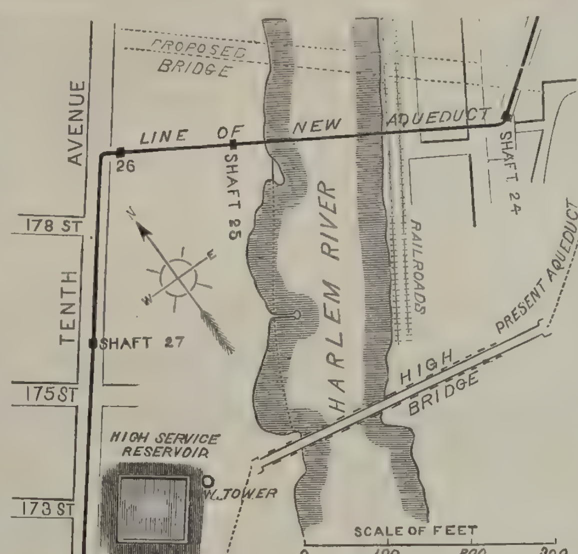
THE NEW AQUEDUCT UNDER THE HARLEM RIVER.

(*Continued from opp. page.*)

long, and is to contain two masonry wells, each 12 ft. 3 in. in diameter, and a drain pipe 36 in. in diameter. The cast iron lining for the wells is to have a tensile strength of at least 16,000 pounds per square inch, is to be 1¼ in. thick, and each ring, at least 5 ft. high, is to be cast complete or in four or more segmental pieces.

One of these wells will unite the aqueduct under the Harlem with that leading to the city, while the other will extend a short distance below the first to form a sump, and is designed to be used as a pump shaft, a gate forming a passage between the lower ends of the two wells. From the top of each shaft, near the top, a blow-off pipe 4 ft. in diameter will lead to a chamber built in the face of the bluff just above the river level, and each pipe at its end will be provided with a valve.

The pump shaft will only be used when it is necessary to remove the water from the tunnel to make inspections or repairs. The water will then be pumped



MAP OF AQUEDUCT AT HARLEM RIVER.

out by means of an ordinary hoisting engine operating an iron cylinder 4 feet in diameter by 15 feet in length. This cylinder or bucket will be lowered into the pump well, when it will fill with water through a butterfly valve in its bottom; when raised, a valve in the side of the bucket will be tripped automatically, and the contents—about 1,500 gallons—will be discharged into the blow-off pipe leading to the Harlem. Of course, the bucket each time needs only to be lowered far enough into the well to fill. As the pump shaft extends below the other, the complete emptying of the tunnel can be easily effected.

Wherever considered necessary, the aqueduct under the river will be lined with cast iron, 1 inch in thickness. This lining will be made up of rings, 2½ feet long, in the direction of the tunnel, and each ring will be composed of four segments, put together by means of bolted flanges. The joints will be made of lead, 2 inches wide and one-sixteenth of an inch thick. The side and flanges are to be accurately faced, and the holes through the flanges are to be drilled to templets, so that all pieces will be interchangeable. Extreme care will be exercised when putting these lining pieces together to make every joint watertight, and after each ring has been put up and fastened to the one already in, the masonry will be built around the iron until it completely fills up all the space between the lining and the inside of the excavation. The great pressure to which this section will be subjected makes necessary the taking of unusual care to insure work of the most perfect description.

The draining of the tunnel during construction will be by a drain cut in the rock below the floor of the excavation to such a depth as to entirely free from water the portions where the masonry of the floor is to be laid. Before the completion of the work, the drains, of vitrified sewer pipe, will be filled with masonry.

Compressed air drilling machines are to be used, and the work of blasting is to be done cautiously, so as not to endanger the roof by exploding too large charges of explosive.

The contract price of the section is $430,000.

Loss of Fire Hose by Acids.

A few days since, a fire occurred in the Harrison Chemical Works at Gray's Ferry, near Philadelphia, resulting in a loss of some $75,000. The firemen from Philadelphia were early at the scene, but were obstructed in their work from the fact that the fire released a large volume of chemicals in the building, which, flowing down the gutters of the street, saturated the hose and destroyed it completely. In a very few moments the chemicals ate holes through the hose, thus stopping the flow of water and destroying the hose entirely. As the adjacent buildings were also stored with various chemicals, the firemen worked in peril of their lives the entire time.

The Mefford Gun.

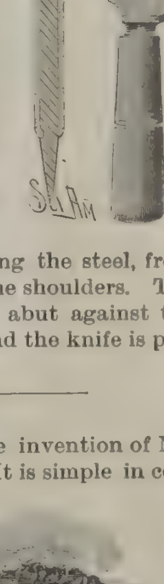
Some experiments were lately made in Washington at the foot of Pennsylvania Avenue southeast, near the navy yard. The gun is a small one, 3 inch caliber, composed of two concentric cylinders, the inside one being of steel, the outside or re-enforce of cast iron, and a space for a non-compressible fluid between. The aggregate strength of the two cylinders is only about one-third that of the navy 3 inch steel gun. The charges fired were the same as the regular charge of the navy gun, there being used one pound of powder and a seven pound projectile. Between the discharges a stopcock was sprung to allow the fluid to flow out, to compensate for the expansion of the inside tube by heat, thereby taking the strain off the re-enforce. The last charge fired contained double the amount of powder—two pounds of powder—and the gun stood the strain well. Lieutenant R. E. Impey of the navy; D. M. Mefford, the inventor; members of the Venezuelan, Japanese, and German embassies, and several members of Congress were present.

Cast Iron Guns.

The *Army and Navy Gazette* says: "It is not to be forgotten that cast iron guns burst in the olden time, as we know by sorrowful remembrance, in our own service and in every navy in the world." Of the iron guns cast on the Rodman principle in this country, we believe but one has ever burst in service, and that was the result of the jamming of a shell, which blew off the muzzle. This gun was mounted on board of one of our monitors. Mr. William P. Hunt, of the South Boston Iron Works, holds that the strength of heavy steel forgings is overestimated and the strength of gun iron underestimated, and that the divergence from the line of truth has become wide. He says: "It is my belief, based upon what I know of the endurance of gun iron castings, that guns made of this material, of the same weight and dimensions as the modern steel guns, are quite equal to the strain which modern gunpowder gives, using the charges adopted for steel guns, and are quite as reliable for endurance. I have backed up this belief by offering to furnish such guns for such test free of cost to the Government, on condition that, should the said guns endure this trial, an order should be given for similar guns, at half the cost of steel guns."

IMPROVED TABLE KNIFE.

Silver plated table knives, as ordinarily made, are formed of steel, are ground, polished, nickeled, and afterward silvered and burnished. Knives made in this way have a dull edge, and when ground the plate is apt to peel away, beginning at the exposed portion of the steel. These imperfections are overcome by an invention lately patented by Mr. Miles A. Morehouse, of Johnsburg, N. Y. The shank and upper part of the blade are forged in the usual way, but near the edge of the knife, at the rounded end and along about half the length, the blade is thickened to form shoulders (Fig. 2), either undercut or square, as the manufacturer may desire.

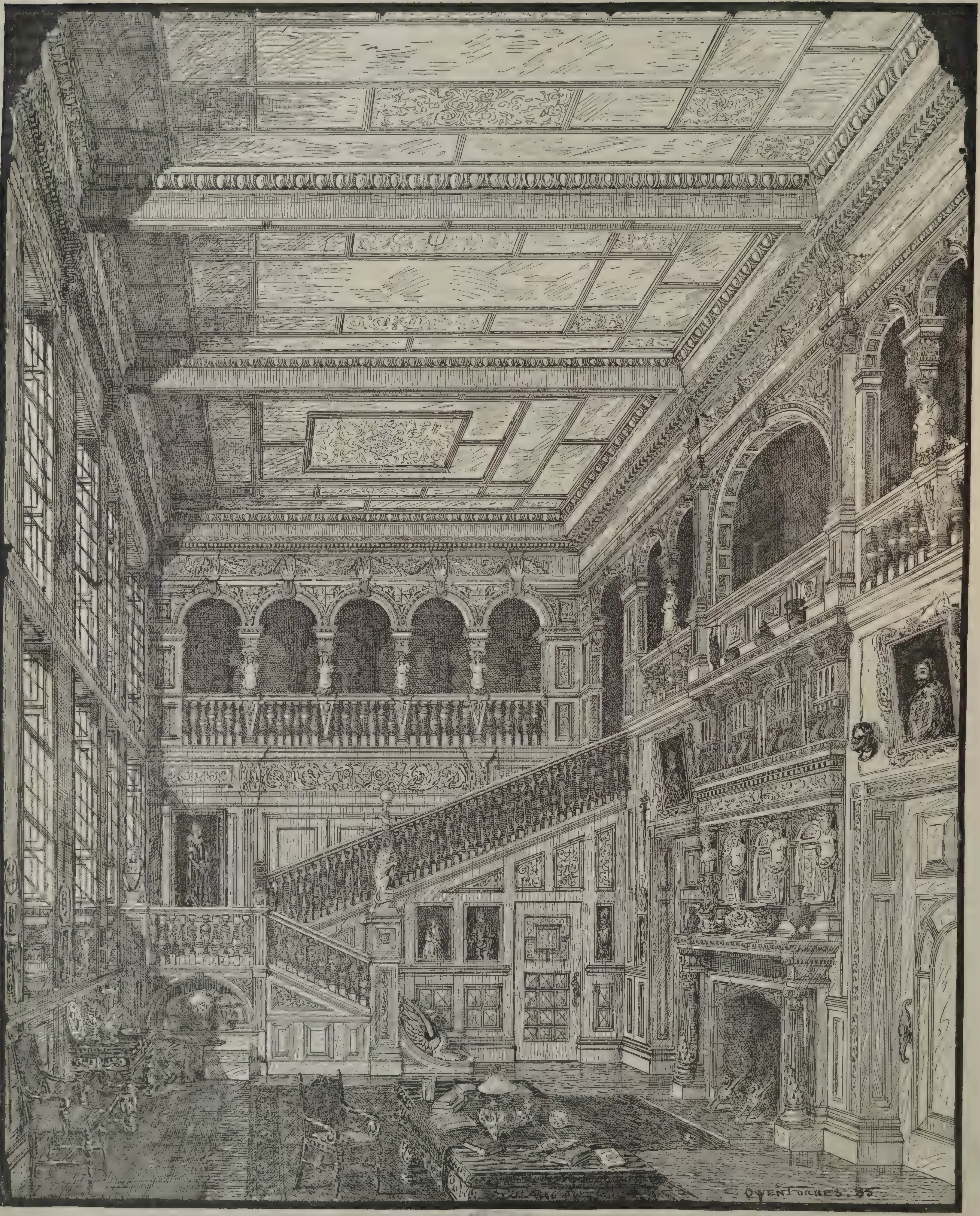


These shoulders may be produced by forming grooves (Fig. 3) in opposite sides of the blade, leaving the other parts of the usual thickness. An electro plating is then applied to the knife, covering the blade entirely. The edge is then resharpened by grinding and polishing the steel, from the extreme edge back as far as the shoulders. The edges of the electro plating which abut against the shoulders are protected by them, and the knife is provided with a sharp steel edge.

TEA KETTLE.

The tea kettle here shown is the invention of Mr. Pierce Ford, of Tucson, Arizona. It is simple in construction, and can be used for warming plates or keeping food warm. On the bottom edge, at each end of a sheet metal strip is a lug bent at right angles to the strip. These lugs are riveted, and the strip is soldered to the top of the kettle. The strip is in the shape of a semicircle, and is placed a

short distance from the edge of the opening in the top. The ends of the bail are pivoted to the ends of the strip, so that no extra lugs are required. The dishes to be kept warm are placed on the bail and strip, which may be ornamented in any suitable manner.



A HALL FOR A MANSION. Designed by James H. Lindsley and Owen Forbes, Architects, Newark, N. J.

THE MONASTERY OF HUELGAS.

This is one of the richest and most venerable monastic institutions of Europe. It was founded A. D. 1187. From an architectural point of view, its most notable feature is the beautiful Roman cloister shown in our engraving, being a drawing by the well known artist Nao.

This cloister is in the form of a square, with graceful columns in pairs, whose beautiful capitals of branching flower work, carved with exceeding delicacy, sustain half-circle arches, simple and severe.

The monastery of Huelgas was for many years the royal pantheon; here rest the remains of thirty-six royal personages, waiting the resurrection of the dead—so read nearly all the epitaphs; among them Alfonso VIII. and his queen, Leonora, of England, who were among the first patrons of the institution. Among the last who were buried here was the Infanta Donna Anna of Austria, daughter of the conqueror of Lepanto and granddaughter of Charles V.

These venerable sepulchers were profaned and robbed by the French invaders in November, 1809, after the famous battle of Gamonal.

Our engraving is from *La Ilustracion*, Madrid.

CLOISTERS OF THE ROYAL MONASTERY OF HUELGAS, NEAR BURGOS, SPAIN.

A Social Doctor.

A court in Pennsylvania decided lately that a will containing this clause was too vague to be admitted to probate:

"The remainder of my estate I bequeath to be used in means to ascertain what children were created to do, that the child may be directed to and instructed in what he or she is best adapted to do."

The man who made the will had the notion that he could revolutionize the education of children by testamentary disposition. Accordingly, he left his family only a fifth part of his estate, and bequeathed the rest to carry out what he regarded as a very valuable and very original purpose conceived by his cranky mind.

He proceeded on the assumption that every child was created to do some specific work, and that the failure of parents and preceptors to discover that aptitude was the cause of the ill success of men and women and of the chief evils which afflict society.

Now, it is doubtless true that a large part of human beings have a hard time of it, because they get into grooves to which they are not fitted. They set out to do intellectual work, when they are really capable of nothing except manual labor. So far as material success is concerned, they are worse off for going to college, for all the time they spend at school after their rudimentary education is over is wasted. Men undertake to be bosses when they are helpless unless they are themselves bossed and directed as if they were children. Men expect to get rich, though they have no faculty of accumulation and no judgment as to the management of money. They want to be capitalists, and hate and envy capitalists because they are not among them, and yet they go through life spending their money as it comes, and are never willing to exercise the self-denial that lays the basis of capital, and never acquire the prudence necessary for the preservation of capital, for it is much easier to make money than to keep it. If half the money spent in New York rum shops was saved, the whole face of the city would be changed, and the number of capitalists would be multiplied.

But all this men must find out from experience. You cannot teach it to them in school, for whether they are made for successful effort depends very much on their heredity, or the qualities they inherit from their ancestors; and therefore the process of making men wise and capable must be a slow one—so slow that ages will pass before they learn to see the foolishness of folly. Not until the last drop of the blood of fools has gone from the veins of the race will folly depart, and then the millenium will be here.

Meantime, society must go along in the old way. Every child must learn to avoid the fire by getting burnt, and must find out that he cannot have his cake and eat it too, though he gains the knowledge through tears and regrets. People must tumble into their places, and take the chances of being fit for them. The vast majority must find out that their rightful positions are in the ranks, and not among the leaders. They must learn that they have no distinguishing aptitude, no great capacity for self-direction, and that they are best off when their natural bosses are in charge of them.

And they must learn the lesson for themselves, and under the tuition of harsh experience. Nobody can help them by leaving money to hunt up means for determining what it is best for them to do, for the majority have no marked and fixed aptitude for special work, though what work they have must be within the capacity of a moderate ability. The great and the successful men of the world, measuring success by merely material results, are always like the few peaks which rise in a vast tableland.

But the maker of this inoperative will was only an example of a large class of people who think to cure the ills of society and to smooth out its inequalities by some artificial device—by legislation, by interference with the laws of trade, by a paternal government, or by no government at all. Their schemes are often pretty enough in many of their parts to be very seductive, but they all have this fatal defect—they do not take into the account human nature, which is always striving for superiority, and refuses to accept any other equality than equality before the law. Life is a battle in which everybody is striving to get ahead.—*N. Y. Sun.*

DESIGN FOR A HALL.

The handsome design for the hall of a private mansion, illustrated in the engraving, is by Messrs. I. H. Linsley and Owen Forbes, the architects, of No. 762 Broad Street, Newark, N. J.

The material intended to be used is polished oak throughout, carved and richly moulded. The ceiling is finished with oak ribs, dividing it into panels, which are to be executed alternately in lincrusta-walton or other raised ornamental work and plain plaster.

It is estimated that the cost of the design in execution would be about $20,000; this sum to include the cost of the fine polished mantel. Without doubt, it would form a really noble apartment.

The drawing has the peculiarity sometimes observed in well executed interior perspectives, of the manner in which the prominent features appear to stand out in relief as solid bodies, similar to the effect produced by looking through a stereoscope. This peculiarity can be observed very well by closing one eye and looking at the drawing from a point about two feet above the paper and immediately in front of the vanishing point.

The Three Graces.

There has been another remarkable discovery in the gardens of Sallust, at Rome, where excavations are going on relative to the process of establishing and building up a new quarter of the city. It is no less than a colossal marble group of the Three Graces, evidently a work executed in the palmy days of ancient sculpture, and of rare merit. It is in a wonderful state of preservation, except the unfortunate loss of all three heads, which, it is hoped, may yet be unearthed. If these be found, it will be one of the most important revelations that this mania for progress and the rebuilding of Rome has yet given us.

American Architecture.

At a recent meeting of the Royal Institute of British Architects, London, Mr. Ewan Christian, president, in the chair, Mr. J. B. Gass read a paper entitled

SOME AMERICAN METHODS.

Mr. Gass, as holder of the Godwin Bursary, 1885, had visited many important cities in the United States and Canada, in a tour extending over three months. He found great practical benefit therefrom, and expressed his obligation to Mr. Godwin for his institution of the bursary, and to the many American architects and others for their courteous reception and willing assistance. The subjects treated on very fully in his paper formed only a portion of his report. The most approved method of incombustible or fireproof construction is a system of iron construction with hollow tile arches, the voussoirs having sides about five-eighths of an inch thick, all the ironwork being incased in ordinary or porous terra-cotta, specially made to suit the positions, and plastered on the top. Partitions or internal walls are made of hollow tiles which have good bearing power; a 5 inch hollow tile wall resists heat better than a 12 inch brick wall. Roofs are constructed of hollow tiles or porous terra-cotta slabs, supported by wrought iron joists, and covered with various kinds of roofing. Underside of the wooden joists and inside the wooden frame houses are made fire resisting by terra-cotta slabs plastered on face. This is being extensively used, and has stood severe tests. Ordinary brick arching in 4 foot spans resting on cross wrought iron girders is still used, notwithstanding many disastrous failures. Concrete floors occasionally are used, in some cases as arching with corrugated iron soffit, in others with wrought iron joists and flat soffit. Slow burning or mill construction is in general use for all sorts of mercantile buildings, and affords excellent protection against fire spreading. Walls of brick, square columns of wood, not tapered, with cast iron pintle between; wooden beams, plank floor 3 inches to 4 inches thick, with hard wood laths in joints, flooring of 1¼ inch hard wood boards with laths, laid over two thicknesses of resin sized sheathing paper or ¾ inch mortar. No painting, varnishing, or filling on woodwork for at least three years after the building is finished. Where there is special danger of fire, the woodwork is incased with bright tin. Roofs with similar construction to floor, with outer covering of tin, asphalt, tar and gravel, cotton duck, etc. Double doors, with air space between, to prevent fire spreading; one door for closing in ordinary use, the other kept open by automatic fastening, which closes in case of fire. These doors are made of two thicknesses, of tongued and grooved boards, covered with bright tin, or made of strong iron. Wire cloth lathing kept ¾ inch from the woodwork and ironwork, and plastered on top, is used for fire protection, as also "Merritt" plaster, the basis of which is asbestine, and magnesocalcite, a saturated paper pulp. Brick walls to houses being generally furred with wood inside before plastering, "fire stops" of incombustible material are used at top and bottom on each floor to prevent fire spreading. In New York and other cities, outside fire escapes are required on all tenement, flat, and apartment houses, office buildings, lodging houses, and factories; stand pipes, with nozzle to each floor, run up alongside the fire escape. In the great fires at Chicago and Boston, brick stood the best for walls, stone calcined, limestone fronts in many cases burnt off, leaving the brick backing standing one or two stories in height. Sandstones stood better than limestones, but granite disintegrated rapidly; artificial stones suffered less damage than natural stones, and mortar stood better than bricks. Cast iron columns failed badly, bringing down whole buildings, and the failure of floors was generally from the exposed ironwork. Telegraph poles got charred, but stood where buildings around were completely destroyed. In conversations with several chiefs of important fire brigades, it was noted that the terra-cotta block system, with all iron incased, was thought by them to be the nearest approach to a perfectly fireproof building; brick arching for floors and ironwork exposed are universally condemned. Slow burning construction with floors made watertight is advocated for mercantile buildings; some place in the roof that could be made to serve as a smoke outlet should be provided in buildings of large size; one wood door covered with tin is better as fire protection than one iron door, but two iron doors with air space between are better than two wood doors. The "fire protection" apparatus for mill buildings is very complete, well arranged, and regularly inspected by the officials of the Mutual Fire Insurance Companies. In addition to other apparatus, sprinkler systems are in general use; these are formed by parallel lines of pipes extending across the rooms near the ceiling and connected with a good water supply. In valve sprinklers, rows of perforated pipes are fixed in sections in which the water can be turned by valves in case of fire. Automatic sprinklers are various forms of apparatus set in action by the fire itself on first breaking out, and are brought to bear directly on the place where the fire exists, and so arranged that when any one of them is in action the flow of the water sets an alarm bell in motion. They are attached to the water pipes at frequent intervals and depend for their action on a solder, fusible at a low temperature, ordinarily at from 150 deg. to 170 deg. Fahr. The Grinnell sprinkler is the most largely adopted, and others in use are the Parmelee, Walworth, Victor, etc.

From the Mutual Insurance Company's returns, 1877 to 1885, in buildings protected by automatic sprinklers, there were 195 fires reported, with an average loss of 327 dollars per fire; in buildings not so protected, 553 fires, with an average loss of 7,794 dollars per fire. Ventilation and heating receive great attention in many parts of America. Owing to the dryness of the atmosphere in the winter, and the greater evaporation from the body, it is necessary to keep a higher temperature in the rooms than is the case in England. At the Massachusetts Institute of Technology, Boston, there is a plenum 3 feet high, under the whole of the basement of building, into which fresh air, warmed or not as required, is put under pressure of ⅛ inch water column. Air is distributed from this to rooms through flues 36 by 12 inches, with steam coil box at the bottom of each, the temperature and volume being regulated by the engineer from basement. The inlets into rooms are 8 feet above the floor, and larger than the area of the flue, so as to insure slow movement. The outlet flues have two apertures in the room, one a few inches from the floor, and the other close to the ceiling —the former wholly used during the school session; the outlets discharge above the roof. The outlets are smaller than the inlets, so as to give pressure against the outside and prevent draughts. The whole system is under the control of the engineer, who maintains a temperature of about 65 deg. in rooms; he is furnished at evening with the weather prediction for the next twelve hours, and is responsible for the thermal condition of the building at the hour of opening, being under explicit orders as to the steam and air supply for various conditions of weather. This system is successful and economical in working. At the Pittsburg County Building and other places, fresh air is taken from top of the tower; it passes over steam coils and though water washer, is put under pressure by fans in large ducts, and conveyed through flues to the rooms, and exhausted into chimney with smoke flue from boiler in center. The systems adopted at the American Bank Note Building; State Hospital for Insane, Norristown, Pennsylvania; Roman Catholic Church, New York; and the Canadian Parliament Houses, Ottawa, were also described. The Baptist Church, Toronto, is amphitheatrical in plan, and has the floor saucer shape. In the winter, fresh warmed air is admitted to the church at the highest point in the floor; the foul air is extracted from the floor level through trefoil openings in each bench end, conveyed by small flues into main trunk in basement, which is exhausted into large vent flue, having the smoke flue from hot air stove in center. There is roof ventilation for summer use. At McVicker's Theater, Chicago, fresh air is taken from 60 feet above ground, filtered, and passed over steam coils in winter and ice chamber in summer, being forced into the auditorium by a fan through openings in the ceiling, and extracted through openings in risers of floors and exhausted by means of fans. The air is changed in the auditorium every fifteen minutes. The system of down current ventilation is used in many public buildings with success, but not available where gas is burned. The extracts at the floor level are ordinarily used in cold weather, however the warm air is admitted into rooms. Heating by indirect radiation is often adopted for houses. The difficulties with, and objections to, steam heating are partially removed by the use of Tudor's fractional valve. In the Canadian cities particularly, many steam heating apparatus have been taken out and hot water systems put in. In houses heated by hot air, steel plate furnaces are found the most satisfactory. Open fireplaces are found in the best houses. The Morse sun rays heater and ventilator is fixed outside the building, and acts when the sun is shining on the black and roughened outer covering. The progress of modern American architecture has been remarkable within the last few years; and, though there is much that is bad, vulgar, and pretentious, it has taken quite a fresh departure, and begun to exhibit artistic and peculiar qualities of a very high order. There is great originality, and the best specimens are scholarly and refined in detail, and adhere less slavishly to precedent than European work. American architects do not hesitate to introduce new combinations, dictated by and growing out of the necessities of the building, without violating the character of the style. Except in the hands of the best men, the desire for originality often led to the worst results, but architecture has only recently become a recognized profession, and the growing and rapidly extending public taste for works of the best class all seem promising signs for the architecture of the country. The best work is accordingly living and interesting, less the production of a dry as dust archæology, and more in accordance with the true principles of all great architecture.

Mr. A. J. Gale (Godwin Bursar) said he rose to propose a vote of thanks to Mr. Gass, and to express his gratification at seeing the drawings Mr. Gass had succeeded in getting to put before them. Without the pertinacity of Mr. Gass himself, and the assistance of American architects, such a collection of drawings would have been simply impossible to get. There was also the difficulty in a tour of study in America that there was so much to see and to investigate. He hoped this would not be the last time a Bursar visited America. One object of the bursary, he believed, was that its benefits should be shared in by architects at home, and he trusted that such had been the case. Still, no one could get the benefit the holder of the bursary himself derived from a personal visit. Mr. Richardson's work as an architect was indeed good. It was needless to speak of its excellence, for it could be seen in the drawings shown on the walls. One of the most valuable services he would render, and was rendering, to American architecture was the training he gave to young men in his office, who, as architects, would worthily succeed him. As to heating and ventilation, the Americans were far ahead of the English. We seldom saw here anything approaching the variety and efficiency of the American systems, the development of which was perhaps due to the climatic difficulties being so great in America. Though they had not the same difficulties to contend with here, they might try and prevail on the public to follow somewhat the example of the Americans.

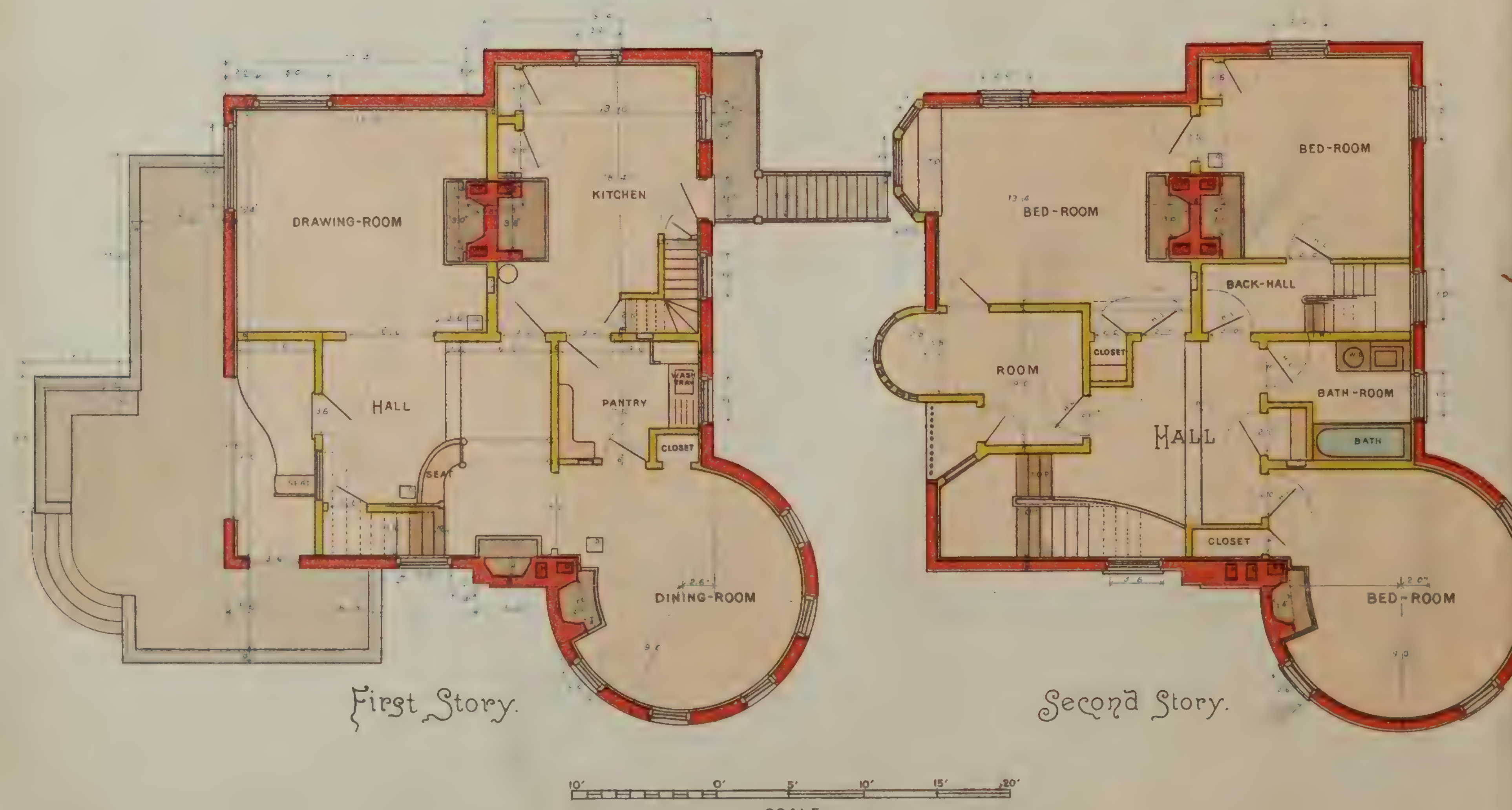
Mr. John Slater seconded the vote of thanks. He remarked that what had been put before them had the advantage that it showed that we had no monopoly of excellence, and that we had a good deal to learn. In fireproof construction, the Americans were far ahead of us. Expense, he thought, might have more to do with this here, but he considered we could make our buildings more fireproof than they now are without going to any great expense. Mr. Slater described a system of fireproof construction of Messrs. Lindsay & Co., which was being used, he believed, by Mr. Waterhouse for the National Liberal Club, and also by Mr. Blomfield, in which steel decking was used with pumice concrete, a construction that was rigid, solid, and extremely light. Mr. Slater then showed that the Americans approached the scientific and constructional problems in a thoroughly practical manner, and so arrived at the only proper solution of such difficulties. He said it was impossible to read the American journals, or the programmes of their institutions, without being struck by the strides they were making in technical knowledge, and, though young as a country, they had done more than had been done in this country for education. He was sure nothing better could happen than that we should learn something of the methods of other countries and take stock of our own deficiencies. With this in view he ventured to make a suggestion. They had a number of honorary and corresponding members; could nothing be done to make those gentlemen less honorary and more corresponding? Communications furnished by them to the Institute would be of great use.

Mr. T. Rickman remarked on the change from the architecture of this country that was seen when traveling in Canada and the United States. Architects in the States had thrown aside the principle of survivalism, and were working out their own ideas. He noticed that he was not shocked by the bizarrerie of the work, but, on the other hand, was greatly pleased. The work was so intelligible, and the object for which the building was erected was so apparent.

Mr. R. Phene Spiers spoke of the influence of the French schools on American architects, and named Mr. Hunt, and also Mr. Richardson, who had been a fellow student of his in Paris. About 1867 or 1868 Professor Ware came over to study English architecture, and subsequently went on to Paris by his (Mr. Spiers') advice about a scheme of architectural education, to be founded at the Institute in Boston. In Paris he collected a large number of valuable casts and drawings of every description, and the system of training he started in Boston he had now started in New York. He (Mr. Spiers) received visits from the most promising of his pupils, who invariably were sent to him, and by his advice they went on to Paris. Mr. Spiers mentioned neo-Grecque as the style taken up by them, and mentioned several buildings typical of the style to be found in that city—a style considered as representative of French work of the second half of the nineteenth century. Bearing this in mind, they would see when looking at Mr. Richardson's drawings whence he had drawn his inspiration. In America local circumstances necessitated certain deviations from the style, which resulted in their designs becoming original conceptions.

Professor Kerr observed that it was necessary to have visited American soil to understand the American line of thought. In two respects it was open to Americans to make considerable progress over the architecture of this country, viz., in ingenuity of construction and originality of design. As to the first, they, to use their own words, beat all creation. The whole population grasped the idea of the necessity of invention. Invention was brought to bear, not in a rough and ready

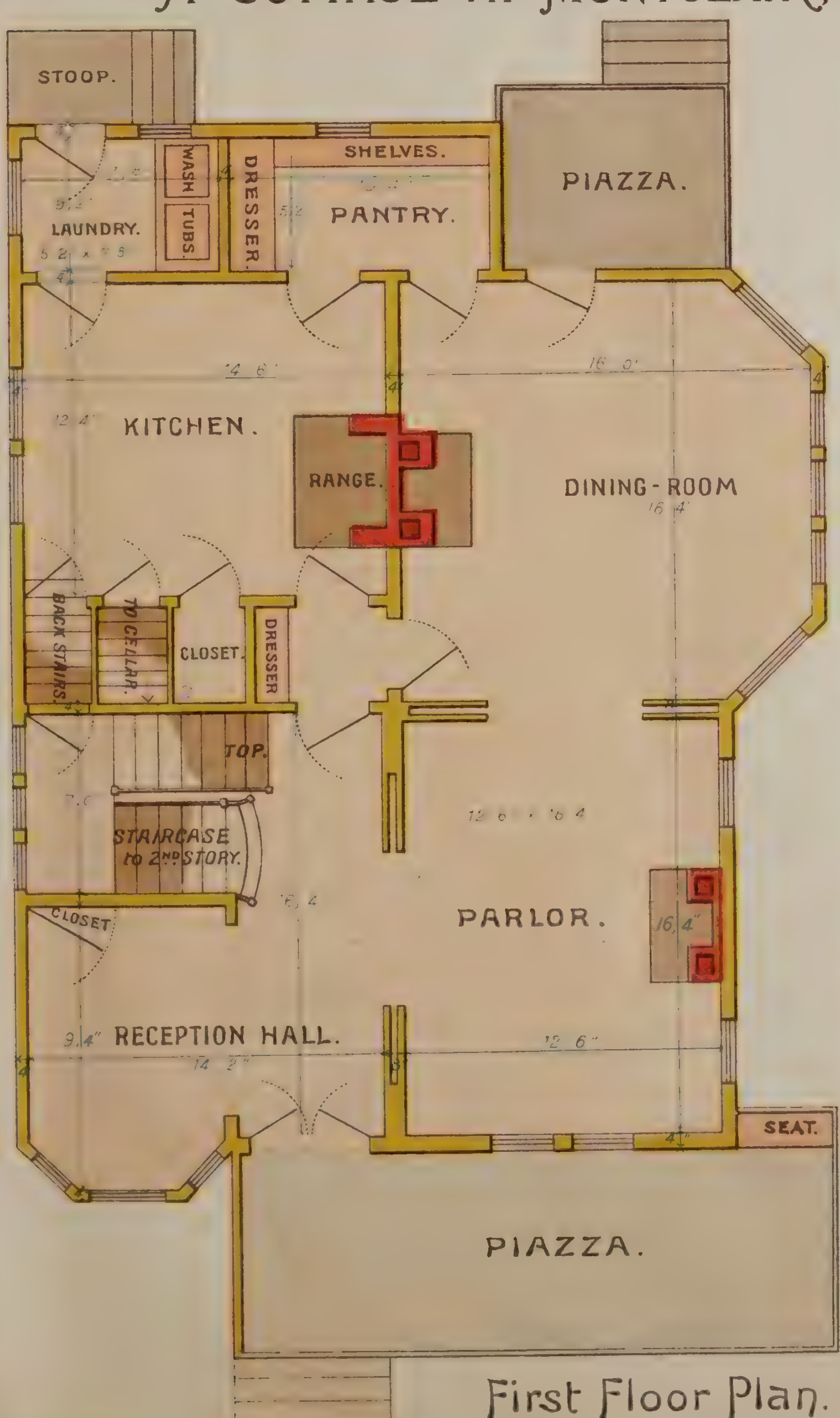
A DWELLING AT ORANGE, N. J. WILLIAM HALSEY WOOD, ARCHITECT, NEWARK, N. J.



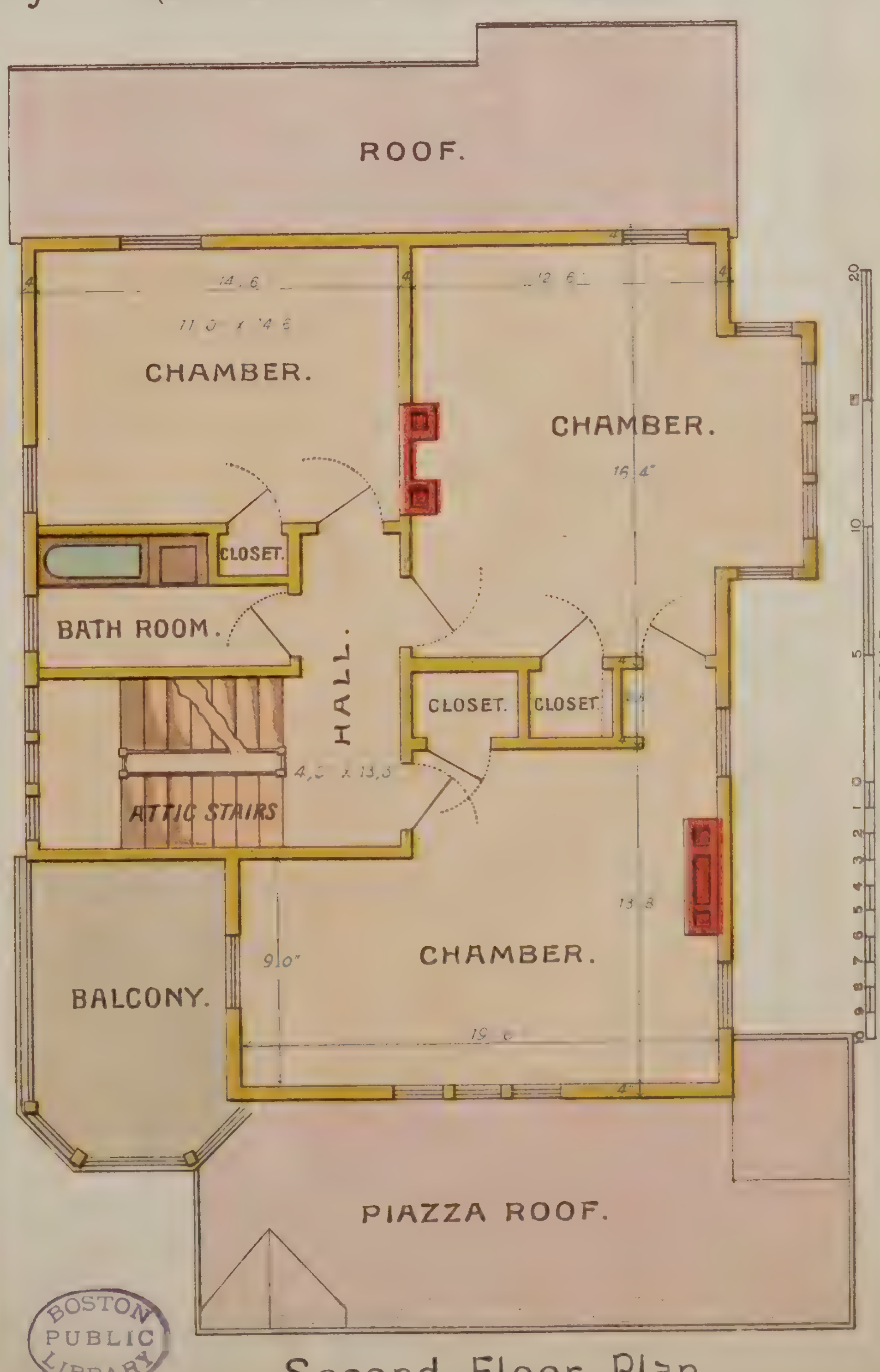
SUPPLEMENT TO THE SCIENTIFIC AMERICAN-ARCHITECTS AND BUILDERS EDITION-JULY 1886.

SCHUMACHER & ETTLINGER N.Y.

A COTTAGE AT MONTCLAIR, N. J. CHRISTOPHER MYERS, ARCHITECT, MONTCLAIR, N.J.



First Floor Plan.



Second Floor Plan.

way, but in a precise way, indicative of the Anglo-Saxon intellect at its best.

In the next few years American invention would no doubt exercise great influence on the buildings there. Our architects were too much trammeled by tradition and instruction. In America that was thrown to the winds. As to design, the position occupied by the American architects was curious. Professor Kerr styled them the English of the future, and said they were far ahead of us in every respect. Design was a much more difficult thing to deal with than mechanical contrivances; but the progress made in design since he was in America about forty years since had been immense. A cosmopolitan style of architecture would in the end be evolved in America, for there, if anywhere, it must be evolved. The development of riches was enormous, and our successors would see architecture in America which was neither sham Gothic nor neo-Grecque.

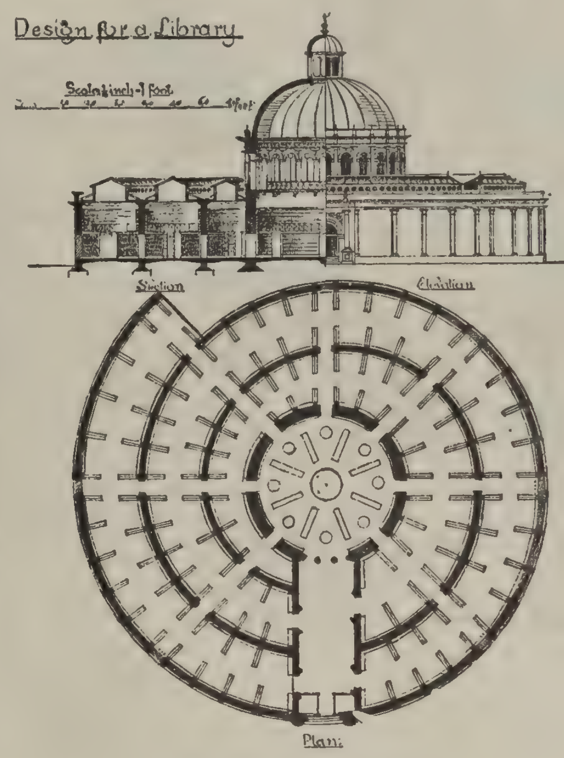
The president expressed the very great satisfaction he had in hearing a paper of this kind read. It showed how far reaching had been Mr. Godwin's ideas in establishing the bursary. No one could visit America, whatever part he might travel through, without learning a great deal. No doubt a person would see much that would disgust him from an art point of view, but the idea he received in America was that a revolution was taking place in which the foundations of a grand superstructure were being laid. The president alluded to the pleasing effect of the tower of Boston Church. It was at the crossing, not lofty, but very massive, its proportions of a scale English architects would never have ventured on; it could not help being effective. The plan of the church was also good; he could not say the same of the details. But Americans could not go slowly. They would not give the time to study that they ought in order to refine their ideas by seeing what had been done in the past. It had amused him to hear that Mr. Gass had found some of the ventilators in the American buildings stuffed up or closed. One could now add to "stupid England," stupid America. There was, however, in America an unusual amount of jobbery to be contended with. Also a change of government involved a change of architects, and a public building which should be creditable one could hardly bear to look at. Here we were freer from jobbery, and he hoped in this respect that our institutions would never be Americanized.

NEW DESIGN FOR LIBRARIES.

A description, by Mr. Eirikr Magnusson, of a new method of planning libraries, was recently published in the *Athenæum*. According to Mr. Magnusson, "the history of the administration of the old libraries of Europe comes pretty much to this, that almost every one has gone through its periods of, first, accommodation without plan in a complex of chambers, until want of premises precluded further expanse; secondly, of internal accumulation and crowding in of auxiliary furniture for storing the books; thirdly, concurrently with this, of constantly impaired lights, ever increasing confusion, arrears, and, finally, a deadlock, which at last forced the authorities to build a new library, regardless of cost, to go, in its turn, again through the same or similar phases. The more rapidly the productions of literature multiply, the more frequently large libraries will have to pass through this periodicity, and the more treasure will have to be thrown away upon their buildings."

Probably many of our readers will be able to indorse the foregoing observations. In order to remedy such a state of things as is described, Mr. Magnusson suggests the building of libraries upon a novel and ingenious plan, as illustrated by the accompanying design, with half section and elevation, which we are enabled, through the courtesy of the editor of the *Athenæum*, and with the concurrence of Mr. Magnusson, to reproduce for the edification of our readers.

According to this arrangement, there is a central rotunda, which forms the reading room, and is lighted by means of windows in the drum above, which is covered with a dome. Around this room is arranged the library, which is really a spacious corridor built in a spiral form, its convolutions being broken by the entrance hall, which communicates directly with the rotunda. In the spirally planned walls are a series of openings, which really form eight radiating passage-ways from the reading room to every part of the library. The openings could, we presume, be closed, either to exclude draughts or to check the access of fire. It will be observed that arches are formed in the outside wall facing each opening, and closed up with masonry or brickwork, which could be removed at any time if the library were extended. The extension would simply involve the continuation of the spiral corridor. The height of the walls is taken at 20 ft., and the width of the passage at about 24 ft. This, however, Mr. Magnusson leaves open to question. Again quoting from his remarks in the *Athenæum*: "Book-cases are fitted to the wall at right angles about 10 ft. in height, exceeding a little in depth the space dividing them. Both sides being used for storage of books, they afford as much accommodation as the adjacent division of the wall. Thus, for book accommodation, a wall, to both sides of which these cases are attached, represents (with the cases) a surface measurement amounting to four times that of one side of it. Along the whole passage light galleries are intended to run, supported for the most part by the book-cases, by which means an easy access is afforded to the upper part of the walls." Mr. Magnusson is of opinion that the warming and ventilation of such a building would be a matter of no difficulty, and in this we agree with him. The arrangement of hot water coils would be exceedingly simple, and provision could easily be made in the "light galleries" for the egress of foul air. The reading room being planned upon the same system as the well known one at the British Museum, it will be seen that an equally perfect system of lighting would be attainable. It is also evident that the central drum or tower could be raised to any height thought necessary for increased architectural effect, should it be partially hidden from view from the extension of the surrounding part. "When once such a library is built," observes Mr. Magnusson, "its expansion can always take place when wanted, at just such a rate as funds for the time being will allow, and without interfering in any way with existing internal arrangements, or the work of the officiating staff, or the convenience of readers." Mr. Magnusson has calculated that a plot of four acres would practically suffice for all time for any library of this description. He states, in conclusion, that the design published was drawn under his direction by Mr. Fawcett, of Cambridge, and that it has been pronounced by Mr. Waterhouse to be "thoroughly practical" when proper provision is made for readers' retiring rooms, areas for admission of fresh air, etc., "and very inexpensive."



DESIGN FOR A LIBRARY.

We can only urge one objection, on the score of expense, against this suggested method of extending libraries. Whatever decorative treatment be applied to the external wall, such as pilasters, arcading, or the like, would have to be sacrificed as it was covered in by additional buildings. The carved or moulded work could not be reused in the new buildings, as is the case with work upon a straight wall, because the curve of the new external wall would be one of larger dimensions, requiring new circular work, with larger interspaces between the pilasters, etc. This objection, however, is not one of great moment beside the many obvious advantages that would be secured by this method of building libraries.

A Cheap Concrete.

A kind of concrete made without cement is said to be coming into favor with Parisian architects. It is composed of 8 parts of sand, gravel, and pebbles, 1 part of burnt and powdered common earth, 1 part of pulverized clinkers and cinders, and 1½ parts of unslaked hydraulic lime. These materials are thoroughly incorporated while dry into a homogeneous mixture, which is then wetted up and well beaten. The result of this is a hard and solid mass, which sets almost immediately becoming exceedingly strong after a few days. It may be made still stronger by the addition of a small proportion—say 1 part—of cement. Among other constructions to which this material has been applied is named as an example a house 65 feet by 45 feet, three stories high, standing on a terrace which has a retaining wall 200 feet long and 20 feet high. Every part of this structure was made of the hard, economical concrete, including foundations, cellar vaulting, retaining wall, and all exterior and internal walls, together with their cornices, mouldings, string courses, balustrades, and parapets. No bond iron was used in the walls, and no wood lintels, beams, or posts were required. It is claimed for this material that it is not liable to crack or scale, and is extremely cheap, as it can be made almost wholly from materials to be found everywhere. Doubtless a further economy could be realized by employing simple machinery for mixing the materials in both the dry and wet stages.

Converting Photographs into Line Drawings.

There are two methods by which a photograph can be prepared for the purpose referred to. The first consists in printing the photograph in the usual way on either plain or albumenized paper and fixing it, care being taken not to tone it with gold. When washed and dried, the image is of a brown color. This must be gone over with a steel pen charged with very black ink, so as to insure the chief features in the photograph being translated into lines more or less thick. This translation of tints into lines seems, to one who looks on when a clever artist is at work, a rather easy thing to accomplish; but for all that it is a feat that demands a high degree of both painstaking care and skill. Suppose the subject is a landscape with figures. Judgment has to be exercised to determine as to how many and which of the numerous trivialities most likely present in the photograph are to be ignored. It is not our province here to give directions as to details in this department of practical art—for it constitutes a far higher branch of art than some would concede it to be—but we may say that it is one upon which it is well worth while spending both time and money in order, by means of tuition and practice, to acquire skill and facility in execution. There is no limit to the skill—nay, genius—that may be imported into this art of translation when accompanied by artistic judgment. Those who have been privileged, as we have been, to be present and watch a skilled engraver work on a photograph printed on a block for subsequent use in the *Century Magazine*, and translating its delicate tints into equally delicate lines, each left standing in relief, would not hesitate about applying the term "artist" to him. But the art that we are here speaking of is, happily, not of such a difficult nature.

The progress of the pen and ink drawing may be watched by examining the work at intervals through a piece of colored glass, of a tint similar to that of the photograph that is being subjected to the translating process. This, by causing the photograph to retire, imparts visual intensity to the black lines drawn by the pen or pencil.

When the drawing is completed, the paper is floated upon a solution of bichloride of mercury, by which the photograph disappears in consequence of its bleaching, leaving the ink lines. From this drawing a negative is made.

We have spoken of two methods by which a photograph can be prepared for the purpose intended, and have described one of them. The second, which is the one we prefer, consists in sensitizing the paper by sponging it over with ammonio oxalate or citrate of iron, exposing under the negative, and developing with a wash of potassium ferrid-cyanide. This gives an image, in a blue color, which does not require to be removed in the after-process of producing a negative from the pen and ink drawing.

From the second negative, which contains lines only, a print is made upon paper coated with albumen and bichromate of potash. This is then blackened with lithographic transfer ink, developed in cold water by the action of a camel's hair brush, transferred to a smooth zinc plate, and etched so as to leave the lines standing in relief, according to processes which do not fall within the scope of this article to describe.—*British Journal.*

Concrete Building under Water.

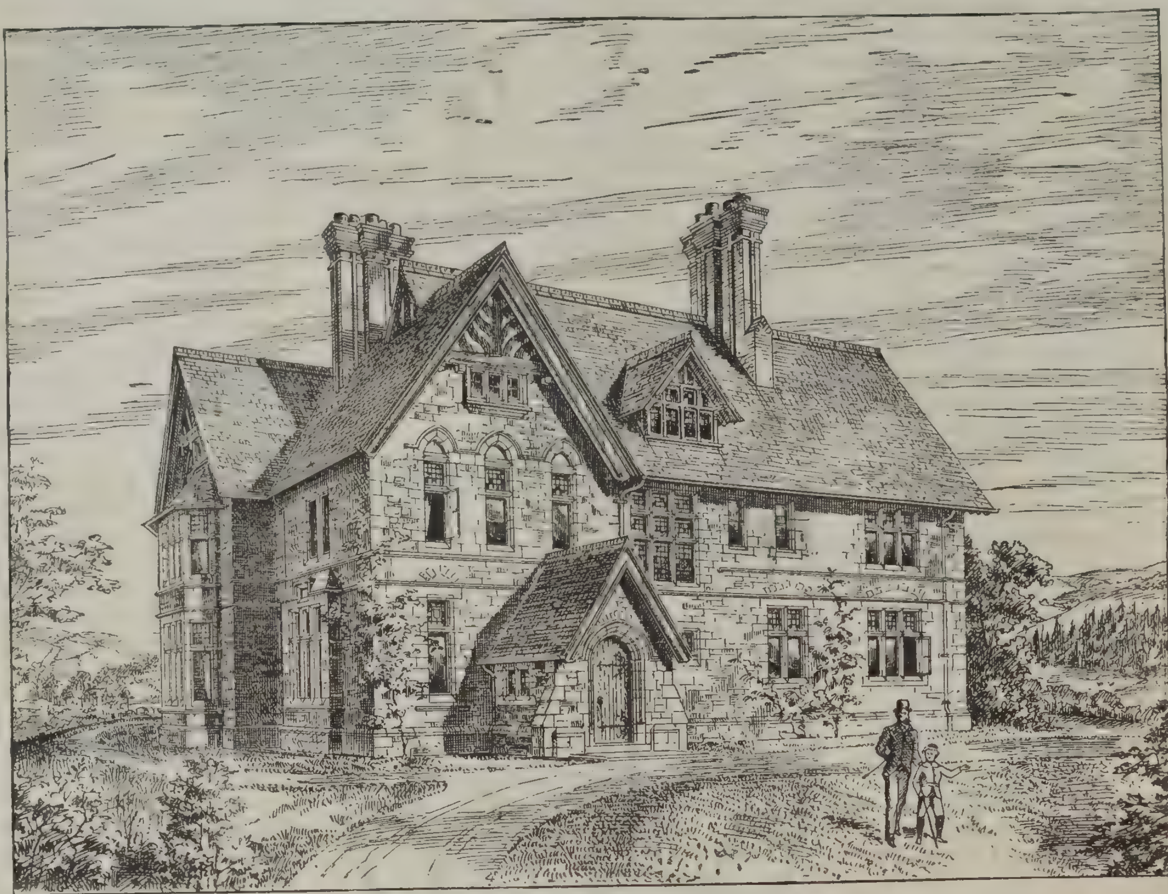
A simple process of lowering concrete under water by means of what may be called the "continuous hopper" has been used in constructing the piers of the large railway bridge over the Loire. The difficulty was to prevent the contact of the concrete with water before deposition. A tube was suspended by a crab winch resting on the usual framework, and while the lower end rests on the ground is filled with concrete. It is then raised, and part of the concrete allowed to run out and settle itself. This, which is the whole of the process, can be repeated at any part within the framework. It has proved both more effective and cheaper than the old process of depositing by boxes.

WITH 1,500 cases on the calendar of the United States Supreme Court, says the *Western Manufacturer*, and the number increasing much faster than they are decided, the Court has taken a vacation of five months, and will not meet again in Washington until October next. Inventors and others who have important cases pending must bide their time until Congress provides another court having jurisdiction to clear the docket.

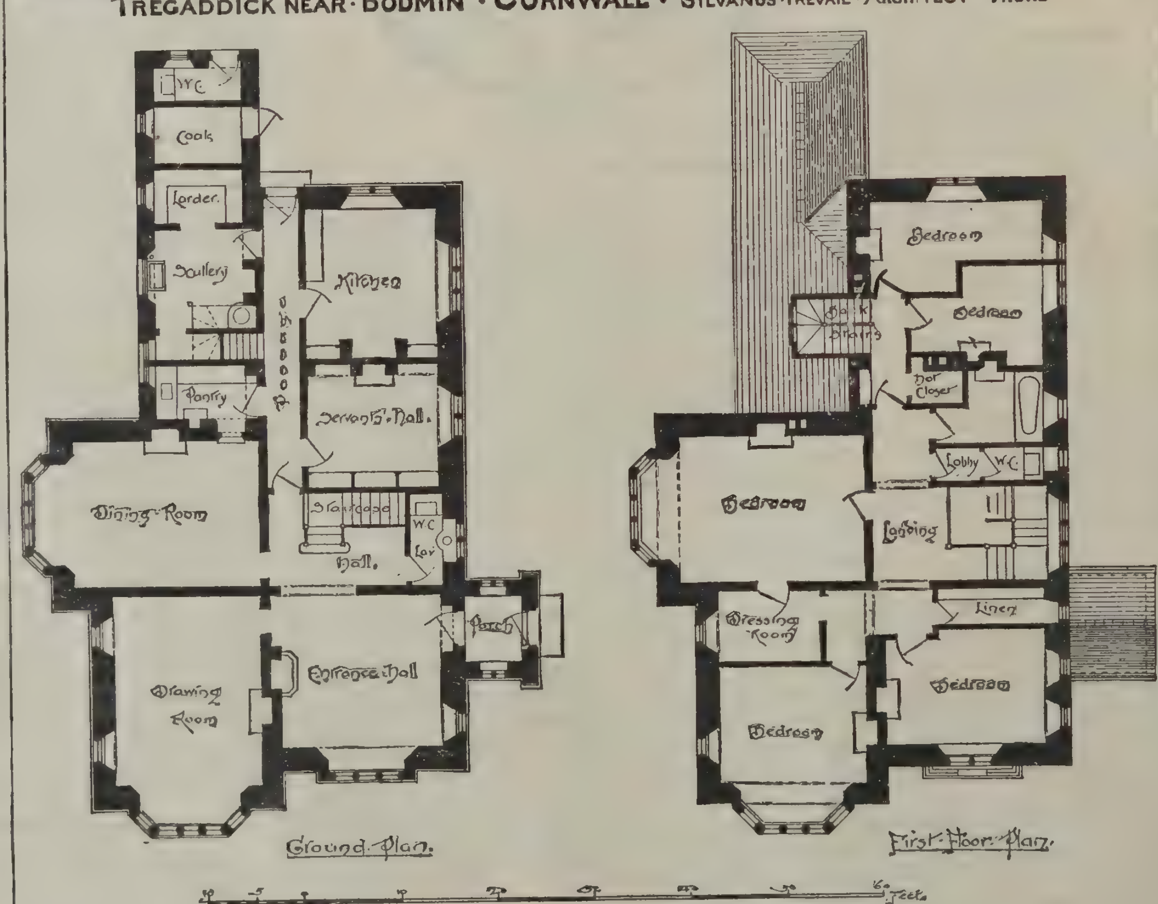
TREGADDICK, NEAR BODMIN, CORNWALL.

This house is being erected for Sir Warwick Morshead, of Forest Lodge, Berkshire, as an occasional residence during the summer months. The site is about five miles north of the county town of Bodmin, and is charmingly situated on an eminence overlooking the picturesque valley of the Camel, near the point where the main stream is joined by the De Lank tributary, in the parish of Blisland. The materials used have been granite rockwork, faced for walling, with Bath stone for dressings, and a half-brick inner wall, with intervening cavity to prevent damp. The covering is of Delabole slate, the quarries being in this neighborhood. The internal finishings are in pitch-pine varnished, and the house is heated throughout with hot water. Above the transoms the glazing is in leaded lights of special design, sporting subjects being introduced in the panels of the hall, fruits in the dining-room, and flowers in the drawing-room, while in the main staircase window various county and family armorial bearings occupy the center of each panel. The work has been ably carried out under the superintendence of Mr. Silvanus Trevail, M S.A., architect, of Truro.

We are indebted to the *Building News* for our engraving. It is a fair illustration of a modern English country residence, and as such will no doubt be interesting to our readers.



TREGADDICK NEAR·BODMIN · CORNWALL · SILVANUS·TREVAIL·ARCHITECT TRURO·



AN ENGLISH COUNTRY HOUSE.

Harbor Survey Work, New York.

Last summer, four Coast Survey schooners were at work in New York Harbor. They were the Eager, Palinurus, Scoresby, and Drift. The first two confined their work to making a survey of the harbor and its shores. The others were engaged in various kinds of hydrographic work, the object of which was to ascertain the center of effort of the different tides and currents which meet and mingle in the harbor. The Drift remained in commission for some time after the other Coast Survey schooners had gone out of commission, and in the cold breezes of October Lieutenant Carter, Ensign Sherman, and Mr. Hassen chased tide-floats over the rough waters of the lower bay, going in their little steam launches out of sight of land.

The first work of Lieutenant Carter and his assistants and of the civil party on the Scoresby was to determine the volume of water entering and leaving the upper bay. It was highly desirable that observations should be made simultaneously at the various places where water enters or leaves the bay; but as the entire appropriation for the survey of the harbor was only $30,000, it was impossible to do so. By means of electric meters, observations were made of the volume of the Hudson at Dobbs Ferry, of the incoming and outgoing tides of the East River at Old Ferry Point and at a point above the Brooklyn Bridge, of the water coming through the Kill von Kull at New Brighton, and of the waters that ebb and flow through the Narrows. At Dobbs Ferry Lieutenant Carter found that while a strong current was coming down the stream, a salt flood tide was running up at the bottom of the river and lifting the whole mass of water, so that while the tide was really running flood, it was apparently on the ebb. The same thing in a lesser degree was observed in the upper bay. The electric meters showed many neutral planes in which the water was perfectly still, while above and below strong currents were running. The volume of water entering the lower bay from Raritan Bay and from the Kill von Kull, southwest of Staten Island, will be taken before the work in that direction will be finished.

Lately, experiments have been made with tide-floats. Poles twelve feet long, loaded at one end, so that when placed in the water one end would stick up about two feet above the surface, were started from a point above the Narrows on an ebb tide. Lieutenant Carter in a steam launch would follow two of these floats as they drifted, steaming from one to the other, and every ten minutes determining the position of the floats by triangulation and noting it in a book. Ensign Sherman and Mr. Hassen, the one in a launch and the other in a dingy, each followed two other floats and determined their position every ten minutes in the same manner, entering it likewise in a book. Day after day floats were started above the Narrows, in the Narrows, and below the Narrows, and chased until the returning tide arrested their progress. From the data gathered in this way by Lieutenant Carter and his assistants, a correct idea will be formed of the action of the tides and currents in the harbor, and the center of effort of the contending forces discovered.

From the Coney Island shore to Sandy Hook extend a series of shoals, which form the obstruction to the entrance of the harbor of New York. Three channels lead through these shoals, the Eastern, Swash, and Main Ship channels. From the Main Ship and Swash channels, just outside Sandy Hook, Gedney's channel leads across the bar, and South channel offers a waterway to vessels bound down or coming up the coast. To open a passage 1,500 feet wide and thirty feet deep at mean low tide through the Eastern channel, 4,600,000 cubic feet of earth will have to be removed. To make a similar opening through the Main Ship and Gedney's channels, 6,000,000, cubic feet, and through the Swash and Gedney's channels 6,500,000 cubic feet, would have to be removed. To open in this manner the Swash and South channel, 7,000,000 cubic feet would have to go. This, of course, will take a large amount of money, but the difficulties experienced by large vessels in getting into or out of New York Harbor have become so great that something must be done.

Now the object is to find the center of effort of the tidal forces and currents, and then to assist nature in opening and keeping open a free passage to the sea, and not to oppose her. Hence the experiments of Lieutenant Carter and his associates. Valuable as the experiments already made are, they are by no means conclusive. In order to determine accurately the thing sought, such experiments should be made in more than one season, as the forces of nature vary at different times.

In the office of the Coast and Geodetic Survey in this city is a perfect representation, on a small scale, of New York Harbor, the rivers running into it, and the arms of the sea stretching from it. Experiments will be made of turning water on this model so that it will flow into the miniature bay at as nearly as possible the same pressure, proportionately, as it flows into the real bay. The waters will be differently colored so that their course can be traced. For instance, a red stream will pour down the Hudson, a blue one down the East River, a black one out of the Kill von Kull, and so on. From this experiment a good idea will be obtained of the way the different currents act in the bay. When all the experiments have been completed, the Coast Survey people will have a pretty fair idea of the action of the tides and currents in the harbor. With this as a basis they will consider which channel it is most feasible to open and keep open. When one of the channels is opened to the proposed width and depth, a string of lighted buoys will make it like a lighted street, and large vessels can enter or leave the harbor at any time of the day or night.—*Tribune.*

A Curiously Made Photo.

F. Jay Haynes says: Last May I made a 20×24 negative of the Bismarck Bridge, which we developed. Shortly after, another plate was exposed on the Columbia River, Oregon, but not developed. The two plates were packed in a plate box, with the usual divider between them. A few days ago, about eight months after exposing, the Columbia River view was developed, and to our surprise a perfect transparency of the bridge appeared on this plate. They were securely packed and protected from light, and the plate was not fogged. We do not attempt to explain the matter, but leave it for more experienced minds to solve.

A good black varnish for iron or other metals may be made by dissolving three ounces of asphaltum, four quarts of boiled oil, and eight ounces of burnt umber. Heat is required to effect the dissolving, and while the compound is cooling, mix with turpentine.

DILATANCY.*

T. O'CONOR SLOANE, PH.D.

Comparatively few papers read at meetings of the British Association for the Advancement of Science receive the compliment of a request for a second reading. Such action was taken upon Prof. Osborne Reynolds' paper "On the Dilatancy of Media composed of Rigid Particles in Contact," by the Association at its Aberdeen meeting, last September. The author illustrated by experiments, brilliant from their very simplicity, some of the theoretical properties of an ether that would act as a producer of electric and gravity strains. Such illustrations must be received cautiously. It will not do to accept an experiment with solid matter as proof that a hitherto theoretical ether has an existence or is in any sense composed of incompressible volumes. But when it is remembered that many of the best minds have come to the conclusion that the causes of gravitation and electricity will never be discovered, anything

DILATANCY.

that hints at an explanation is most welcome. It is for this reason that Prof. Reynolds was so well received by his associate members. On Sept. 10, 1885, he read his paper before Section A; and by request, on Sept. 15, he read it again before Section B of the Association. The original paper, giving the mathematics of the subject, and pointing out its possible explanations of some of Clerk Maxwell's theories, is given in the *Philosophical Magazine* for December, 1885. This paper may be confidently recommended to our readers.

But apart from the theoretical bearing of the newly discovered law, its experimental illustrations are so simple and striking that they will interest all. In the cuts are shown some of the experiments that may be performed with such simple apparatus as an India rubber bag and a glass tube.

In Fig. 1 is shown an illustration of two orders in which solid particles may be arranged, the close order and the loose order. The dotted lines in the loose order show the size of the including cube. It will be seen that the particles in loose order occupy much the larger volume. The phenomena of dilatancy depend on the power of rigid particles of any shape to arrange themselves in loose or close order.

Let an India rubber bag, such as is used for toy balloons (one which has been inflated, and thereby stretched well, is the best) be filled with dry sand. The thinner and more elastic the bag, the better. Then by a perforated cork secured tightly in its neck a bent glass tube is connected, opening into its interior, as in Fig. 2. The bag is first shaken in the palm of the hand, so as to bring about a close order of the sand. The end of the tube is dipped into water. Now, the question may be asked, What will happen if the bag is squeezed? The most natural answer is that air will be driven out; but on compressing the bag no such action takes place. As the bag is squeezed, water rises up into the tube and by properly proportioning the relative sizes, the fluid may be drawn over the bend of the tube and into the bag. Extraordinary as the result seems, it is easily explained. The sand originally was in the close order, by squeezing it was brought into the loose order, the open spaces between the particles were dilated, and water rose under the influence of the partial vacuum.

A larger bag, such as is sold in the India rubber stores for use as an invalid's ice bag, is better. These are made of thin white India rubber, of good quality and highly elastic. The neck may be closed with an India rubber cork, secured by very tight winding with string or by a strong rubber band. Such a bag, containing sand and then filled with water, is represented in Fig. 3. The sand must first be put in until the bag seems about full, then water must be poured in until the air is entirely displaced. A bent tube, as before, is inserted in the cork, and the end dipped in a vessel of mercury. The bag is now strongly squeezed (Fig. 4). Any excess of water that was collected above the sand disappears. The India rubber around the cork becomes shrunk and wrinkled under the tension, and the mercury begins to rise, until, if all is properly conducted, a full, or nearly full, vacuum is shown. To produce a full vacuum, absolutely no air must be contained in the bag; the space not filled with sand and the tube around its bend and above the mercury must be full of water. The sand has been disturbed, and brought out of a condition of close into one of loose order. When the bag is pressed and the excess of water disappears, it becomes comparatively rigid. It seems quite unamenable to pressure.

But if the pressure be accompanied by shaking, then the sand is kept in its close order, and any shape can be given to the bag. This operation is shown in Fig. 5. The bag can be rolled into an irregular cylinder, or can be kneaded into a disk without trouble, provided it is shaken continually. When made into a disk, if it is placed on its edge and subjected to pressure, it will yield a little, but ultimately take its final shape, as in Fig. 6, when the entire weight of the experimenter can be supported by it. In this way hard rigid blocks, such as shown in the same cut by the side of the observer, are produced. When one of these blocks is placed cork uppermost, or in the position it occupied while being shaken, and the least agitation applied, it settles down instantly into the soft mass of sand and water that it was originally. For these experiments the perforation in the cork must be closed.

In all these cases, the force that is brought into action is the atmospheric pressure. By changing the order of the grains the tendency is to an enlargement of volume, which would produce a vacuum. Hence the conservation of the shape by the weight of the atmosphere appears.

The resistance offered by a cloth or canvas bag of sand to change of shape, utilized in supporting bridge centers, and the sudden drying of wet sand around the foot upon the sea shore, receive a ready explanation in this law. As a rule, all manner of rigid particles inclosed in or by a movable boundary display it in some degree. It even has its bearing on the angle of repose of different sands.

The experiments can be performed with shot or marbles or any small particles, as well as sand, but on account of its lightness and fineness the latter is generally preferable. We have only given a few of the experiments. Our readers will see that there is room for many others. Small bags of sand and water can be shaped into disks and rolled the length of the room. Large marbles ¾ of an inch in diameter can be substituted for sand. The great point and difficulty is to prevent air leaking into the bag. It interferes, in degree only, with the success of the work.

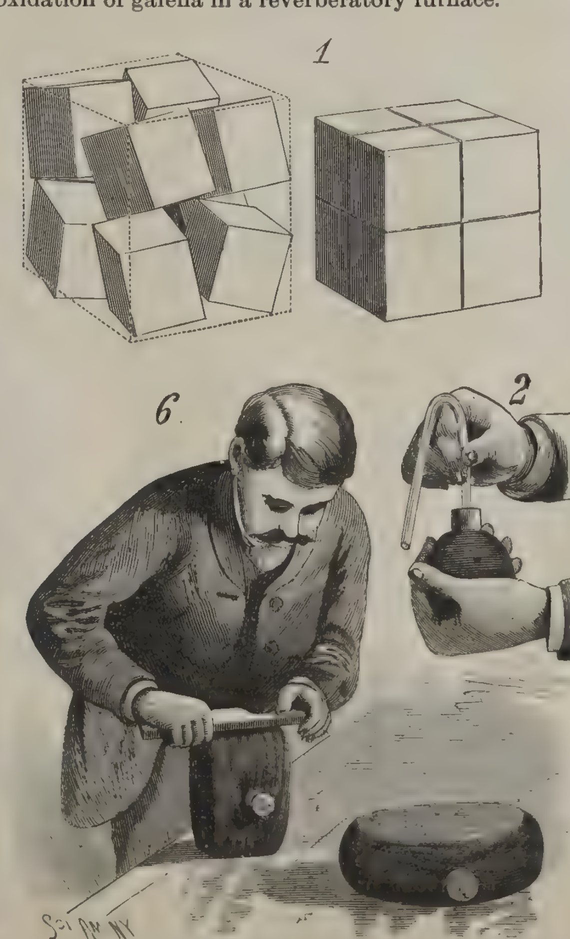
* See SCIENTIFIC AMERICAN, April 10, 1886, for a review of a recent lecture on this subject by Prof. Osborne Reynolds.

Manufacture of Mineral Colors in the United States.

The following particulars, taken from the "Report of the United States Geological Survey on the Mineral Resources of the States," have been furnished to the *Chemical News* by the author, Dr. Marcus Benjamin.

There are in the States 31 white lead works, in all of which the so-called Dutch method is followed, the material used being pig lead. The total produce during the year 1884 was about 65,000 tons.

A "sublimed lead" is made in Missouri by the direct oxidation of galena in a reverberatory furnace.

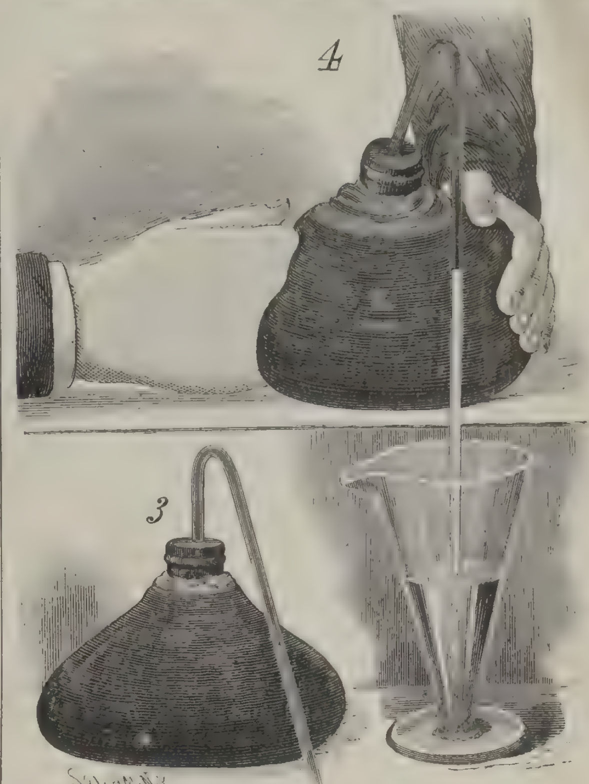


EXPERIMENTS IN DILATANCY.

Zinc white was manufactured in the same year to the extent of 12,000 to 15,000 tons. It is used not only as a color, but in the manufacture of India rubber, in pottery, and in the paper trade.

Barium sulphate (heavy spar) was raised to between 25,000 and 30,000 tons. Barium compounds are used as paints under the names of blanc fixe, satin white, etc., and in the form of peroxide for bleaching purposes. Barium sulphate, both the natural and the precipitated, is largely used as an adulterant.

Terra alba (ground gypsum) is imported from Nova



DILATANCY.

Scotia, while a superior quality is brought from France. In addition to its legitimate use in making white pigments of a low grade, it serves for adulterating a variety of commercial articles.

The quantity of red lead produced in the United States could not be ascertained, but the imports at New York amounted to 198,588 pounds.

The American production of litharge is also an unknown quantity. The imports were only 54,183 pounds.

Concerning ochers, it is said that with the possible exception of the deposits recently opened up near St. Louis, the American production is inferior to the imported qualities. "American ochers for the most part lack strength or tinting properties, and require too much oil for grinding." The annual consumption in the United States is estimated at 10,000 tons, of which about 3,000 tons are imported.

American umbers are inferior to those imported from Italy and Turkey. Sienas are found to a small extent in Virginia and Pennsylvania, but most of that used is imported from Italy.

There is no mention of lapis lazuli having been found in the United States, but there are two American manufactories of artificial ultramarine, with a yearly output of 1,400 tons.

Ground slate is used as a pigment to the extent of 2,000 tons yearly, and occurs in four colors—green, red, slate, and drab.

An Improved Developer.

Dr. A. A. Mantell, in the *British Journal of Photography*, recommends the following formula:

1.	
Pyro	1 drachm.
Citric acid	5 grains.
Sulphite of soda	1 drachm.
Water	10 ounces.
2.	
Carbonate of potash	1 ounce.
Water	20 ounces.
3.	
Bromide of ammonium	2 scruples.
Liquor ammoniæ fort.	1 drachm.
Rain water	20 ounces.

For development, mix equal parts of 1, 2, and 3; in cold weather a little more of 3 may be used.

The advantages obtained by its use are: 1st. Greater rapidity in development than when soda and potash are used alone or in combination. 2d. Comparative freedom from the yellow tinge caused by soda. 3d. Greater density than can be obtained by ammonia alone. 4th. Greater detail than can be got by soda alone.

MR. THERON E. PLATT, of Fairfield county, Conn., has raised two hundred varieties of potatoes on his farm during the past year. The study of fungoid pests of the potato has also occupied his attention, and his discoveries respecting certain diseases of this plant are likely to prove serviceable.

The Heliograph in Arizona.

A correspondent of the *Army and Navy Register* says the troops in the field in Arizona are now moved almost wholly by heliographic orders. He writes: "We have now six heliographic stations, running from Bowie's to the Mexican line. They work better than any line ever has worked before, this climate being very fine for sun flashing; messages of 150 and 200 words being sent down the whole line in thirty minutes, over 300 messages having been sent within ten days. The glasses used are home manufacture, from the design of Lieutenant Alvarado M. Fuller, Second Cavalry."

The Commercial Destiny of America.

The *Deutsche Rundschau*, which is published in Berlin, in an article commenting on the shifting center of the world's commerce, says: Great Britain's share in the commerce of the world in 1868 was 25 per cent. In 1882 it had fallen off to 19·5 per cent of the total foreign commerce of Great Britain and the Continent; in 1868 it was credited with 34·5 per cent, and only 29 per cent in 1882. In 1868 Great Britain produced 55·6 per cent of all the coal mined in the world; in 1883 only 40·7 per cent. In 1868 the English output of pig iron represented 44·1 per cent, and in 1883 only about 39·1 per cent of the total amount. In the five years from 1856 to 1860, England consumed 60·3 per cent of all raw cotton produced, and the Continent of Europe 39·7 per cent; but in 1883 the British cotton trade fell to 52·3 per cent, while that of the Continent rose to 47·7 per cent.

The decline in English manufactures during the past seven years can safely be estimated at one per cent annually. Great Britain's loss has been the gain of Germany, but the center of gravity of the world's commerce will ultimately rest in America. Iron and cotton are destined to be the staples of the United States, as they are now of England, but England has to expend a large amount of money every year for breadstuffs and provisions to sup ly the wants of her industrial population. The people of the United States, on the other hand, are not only able to feed themselves from the products of their land, but can, besides, from their abundance meet the needs of Great Britain and the Continent. They also have raw cotton and iron at the doors of the manufacturers, and thus possess a double advantage.

AN OLD OAK CHAIR.

Our engraving is of an oak chair drawn to scale, with details of the several parts set out at large. The character of the work thus delineated is so evident

that no further description really is called for. The chair itself is a comfortable one, and has an air of homely art about it, without pretense or unnecessary show. Our sketches, which are from the *Building News*, will doubtless enable any one of ordinary skill to construct an old oak chair to the best advantage.

THE SPRING MATCH.

In nailing down a floor, when the floor boards have been tongued and grooved, for the benefit of the dirt and dust that may find their way through the seams of the floor joints, as well as for the foul gases that underlie a basement floor, the flooring must be set up solid, with some sort of a lever arrangement that gets a firm grip on the floor joist, or they must be sprung into place by crushing in the boards that have been left to

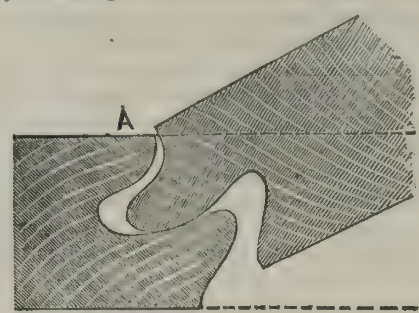


Fig. 1.

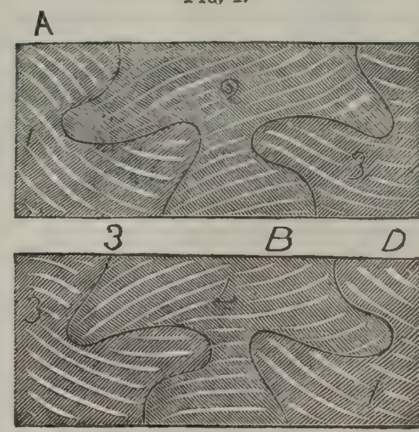


Fig. 2.

form the rafters of a truss that are to crowd every joint in place to bring the boards in line, unless a wedge is brought into use by nailing a footpiece on the floor joist and keying up the floor boards till every seam is closed, regardless of the warping twist that has been left in the worst board of the lot while undergoing the process of seasoning. To spring a board in place by leaving two or more of them to be crushed into line, the space is left a little scant, and when all is ready the boards are made to arch over the space by using the flooring on each side for an abutment. One or more workmen stand on the ridge of this low-roofed structure, and with care and close attention the seams of every joint close tightly to make room for the boards, that must have all the room that can be provided for them. With matched boards, or where the flooring has been tongued and grooved, this spring method of closing a seam does not admit of so tortuous a treatment unless the boards have been grooved for this special purpose. We have seen the tongue of matched floor boards trimmed off on one side with a rabbet plane, and the groove widened for the purpose of springing one of the boards in place to set up the seams in the flooring tightly. Where the boards are not very thick, they may be induced to come into place; but for mill flooring, where the boards are nearly as thick as they are wide, several of them must be taken together if the joints are to be benefited by the operation. A form for a tongue and groove is shown in Fig. 1 that was designed to lock the boards together and bind the joint firmly in place without opening the seam. The bearing surfaces are curved about a common center, which is found in the level of the floor surface, shown at A, and each board must be carried about this center when the matching is driven together, just as they would be driven if the floor board could be sprung into place. All that is required is to match the boards with this form of a tongue and groove, moulding them so that the joints will come together in each of the four seams, as shown in Fig. 2. Every fourth board is nailed firmly in place after allowing for the amount of compression; then the first joint allows the second board to be elevated on the matching by turning from the center, A, leaving the third board to remain in a level position by opening the joint on the center, B. The third seam still has the center on the under side and braces from the fourth joint, which faces opposite from the first one in the set. Then the central board in each set is drawn down with floor nails, and all the floor cracks closed firmly against the penetration of floor dust and sweepings.—*Boston Jour. of Com.*

Good for Vermont.

This State has passed a law making the adulteration of maple sugar or honey with any substance whatever punishable by a fine of from $25 to $50. The Vermonters evidently mean to retain their good reputation for pure maple sugar and honey.

Durability of Different Woods.

The *American Builder* relates this result of experiments that have been made by driving sticks, made of different woods, each 2 feet long and 1½ inches square, into the ground, only ½ inch projecting outward. It was found that in five years all those made of oak, elm, ash, fir, soft mahogany, and nearly every variety of pine were totally rotten. Larch, hard pine, and teak wood were decayed on the outside only; while acacia, with the exception of being also slightly attacked on the exterior, was otherwise sound. Hard mahogany and cedar of Lebanon were in tolerably good condition. But only Virginia cedar was found as good as when put in the ground. This is of some importance to builders, showing what woods should be avoided, and others used by preference in underground work.

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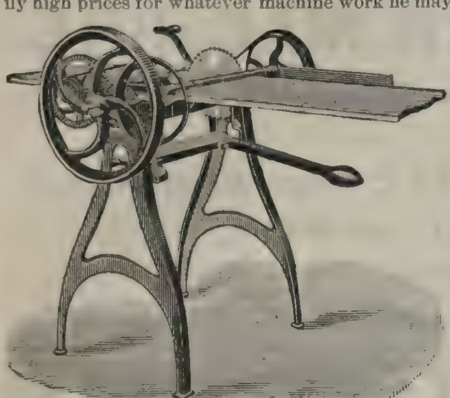

[Hand Circular Rip-Saw.]

wish done. Often at their prices he can make good day wages doing the same work by hand, by the old-time methods.

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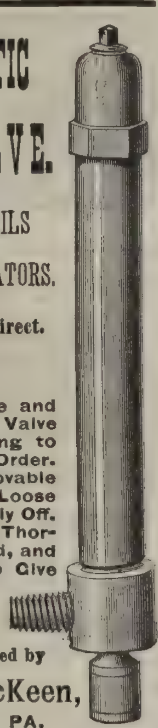

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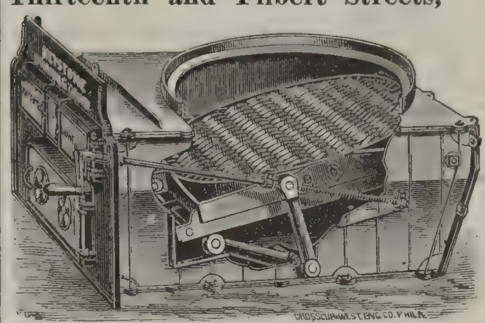

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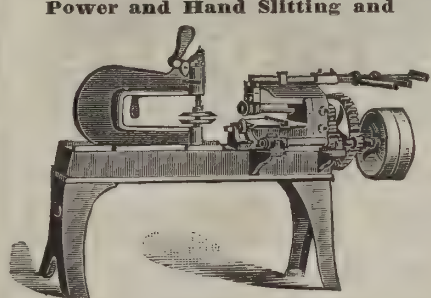

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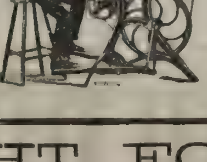

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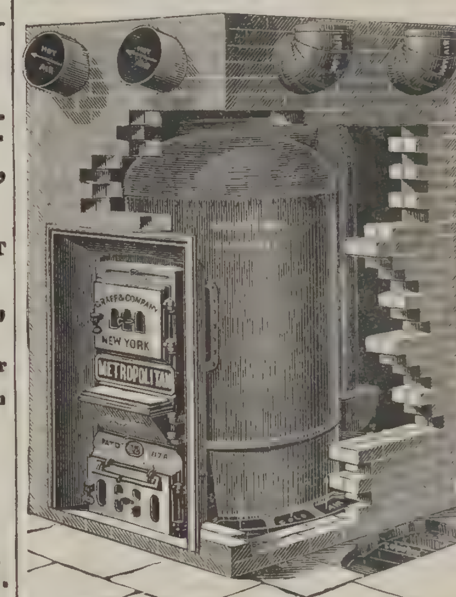

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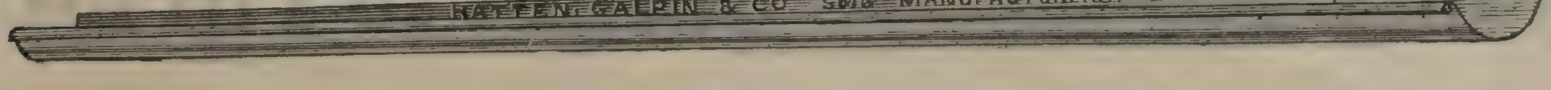

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(2) W. T. S. asks: How many feet board measure, allowing ¼ of an inch for the kerf of the saw, in a stick of timber 48 feet long, 10 inches by 10 inches square? A. If you sell the stick of timber at board measure, no allowance should be made for resawing, and it should tally 400 feet board measure. If allowance is agreed to for resawing, the stick will cut seven 1 inch boards and one 1¼ inch board or plank, and should then tally for the whole stick 330 feet board measure.

(3) W. F. R. asks: What material is the best to paint a tin roof? A. Prince's metallic paint and boiled linseed oil. 2. How can I make human manure into a fertilizer? A. By mixing with dry soil. 3. What is the best plan to build a private icehouse—above or below ground? Give me the best plan for both. A. Below ground, all but roof. See Scientific American Supplement, Nos. 59, 55, 99. 4. I have two large skylight glasses that are cracked across. What can I use to stop them from leaking? A. Putty a strip over the cracks, or put in a new light. 5. What is the best soldering fluid to use on an old tin roof, that has been painted with tar? A. Tinner's acid, zinc dissolved in hydrochloric acid, and add a little sal ammoniac. Scrape the tin where you intend soldering. If at all possible, use resin, as it makes a better job than acid. 6. How can I make whitewash that will not rub off? A. Put a little white glue in the whitewash. 7. What is the name of the best brand of tin that is made? A. There are over three hundred brands in the tin trade; generally the more letters, as X, XX, XXX, etc., the thicker the tin.

(4) In answer to P. D. P., March 27 (in regard to boiler feed pipe and heater pipes becoming partly filled with hard lime scale), E. A. T. writes: I would say, cut a piece of pipe one or one and a half inches larger diameter than your blow-off or feed, and slip it over it or them wherever they are exposed to great heat, and you will never have any more trouble with their filling up. I learned this from my Scientific American ten years ago or more, and it has been worth a great deal to me in that time.

(5) F. T. R.—Nitric acid dissolved in twenty to thirty parts of water is used to etch zinc with. An excellent liquid to be used in writing on zinc is ¼ ounce platinum chloride dissolved in 1 pint soft water. It is very expensive. This solution must be kept in glass, and the writing executed with a quill pen.

(6) H. C. B. desires a recipe for making a peacock green stain which will penetrate into wood. A. A green stain is produced by a solution of verdigris in nitric acid; then by dipping into a hot solution of pearlash, the color may be changed into blue. By varying the strengths of the solutions used, the exact shade desired by you can be obtained.

(7) C. H. T. asks how to make bay rum from the bay oil. A. Take 10 fluid drachms oil of bay, 1 fluid drachm oil of pimento, 2 fluid ounces acetic ether, 3 gallons alcohol, and 2½ gallons water. Mix, and after two weeks' repose, filter.

(8) C. A. K. asks the process for tempering steel springs in the shape of rings, 11 inches in circumference. A. Such a spring should be heated in a muffle or oven, lying upon a plate of iron. When at a cherry red heat, it should be dropped in the water edgewise, so as to keep its shape. This may be done by dexterously and quickly turning the plate over, so that the spring may drop edgewise. A wire frame is sometimes used, and the spring heated in a charcoal fire and handled by a wire loop, from the frame.

(9) H. W. B. asks: How can I bronze a plaster cast? A. Go over the figure with isinglass size, until it holds wet, or without any part of its surface becoming dry; then with a brush go over the whole, taking care to remove while it is yet soft any of the size that may lodge on the delicate parts of the figure. When it is dry, take a little thin oil gold size, and with as much as just damps the brush go over the figure with it, allowing no more to remain than causes it to shine. Set it aside in a dry place free from smoke, and in forty-eight hours the figure is prepared to receive the bronze. After having touched over the whole figure with the bronze powder, let it stand another day, and then with a soft dry brush rub off all the loose powder, particularly from the points or from the more prominent parts of the figure.

(10) E. J.—To paint on glass, take clear resin 1 ounce; melt in an iron vessel, let cool a little, but not harden; then add oil of turpentine sufficient to keep it in a liquid state. When cold, use it with colors ground in oil.—The following is a receipt for a liquid which will remove ink from paper: Take of chloride of lime 1 pound, thoroughly pulverized, and 4 quarts soft water. The above must be thoroughly shaken when first put together. It is required to stand 24 hours, to dissolve the chloride of lime; then strain through a cotton cloth, after which add a teaspoonful of acetic acid (No. 8 commercial) to every ounce of the chloride of lime water. The eraser is used by reversing the pen holder in the hand, dipping the end of the pen holder in the fluid, and applying it, without rubbing, to the word, figure, or blot required to be erased. When the ink has disappeared, absorb the fluid with a blotter.—See Scientific American Supplement, No. 438, for information about gelatine copying pad or hektograph

(11) G. R. L. asks how to prepare a wash suitable for coloring an external wall a dark terra cotta tint. A. A wash for external work, said to be good, is formed in the following manner: Slake a shoveleful of good lime in about a quart of warm blood, fresh from the slaughter house. Place in ordinary pail, and add a sufficient quantity of skim milk and beer grounds, boiled together, to fill the pail. Well stir the mixture, which will then be ready for use without the addition of water, and will stand the weather as well as oil paint. Another reported wash of excellence is formed by mixing one gallon of lime slaked with one gallon of wood ashes, ¼ pound of powdered alum or borax, and sufficient soft water to render the mixture of the consistency of cream. Color may be added to suit; 15 pounds of whiting and half a pound of fresh slaked lime, dissolved in skim milk, makes another hard and durable wash. To produce a terra cotta color, add 1 part of Indian red, 1 part of common lamp black, 3 parts of umber, and 1 to 2 parts of yellow ocher or chrome yellow, varying the quantity of the latter until the desired tint is obtained.

(12) C. S. M. asks how to make an ink that will not appear on paper unless the paper is heated. A. Dissolve 1 fluid ounce common oil of vitriol in a pint of soft water. Stir well, and allow it to cool. Write with a clean pen. When dry, it will be invisible; held to the fire, it turns black.

(13) J. S.—For a cement floor, you may use 1 part of Rosendale cement to 2 parts of clean sand and 4 of gravel or other suitable ballast. Lay to a depth of from 2 to 6 inches, depending upon the soil underneath and the purpose for which the floor is to be used. If you wish a first-class floor, finish with a thin layer of Portland cement and sand in the proportion of 1 of the former to 2 of the latter. To find the quantity of material, ascertain the number of cubic yards in the floor, and allow 34 cubic feet of material or one and one-tenth cubic yards of gravel and sand and 3 bushels of cement for every yard.

(14) W. E. D. asks the process of casting bass relief tiles in bronze. A. The mould is made in sand from a pattern in the same manner as for ordinary brass work. For special description of bronze casting see Scientific American Supplement, No. 101, and for finishing bronze work see Scientific American Supplement, No. 39.

NEW BOOKS AND PUBLICATIONS.

The Architect's and Builder's Pocket Book. By Frank Eugene Kidder, C.E. New York: John Wiley & Sons, 1886.

In the convenient form of a pocket reference book, Mr. Kidder has collected a mass of information of immense value to all architects and builders. Almost every subject which they will be called upon to consider in the course of their professional experience is clearly and briefly explained somewhere within its 600 pages. The chapters on the strength of materials and the stability of structures are of particular value; the more so because so many, even in active business life, are always puzzled when it comes to the calculation of these very important elements. The work is illustrated with 423 engravings, the majority of which are from orignal designs. It contains also, in addition to the subjects strictly germane to its title, a great variety of information on miscellaneous topics.

Wonders of Architecture. Translated from the French of M. Lefevre. With a chapter on English Architecture, by R. Donald. New York: Chas. Scribner's Sons, 1886.

The Messrs. Scribner's Wonder Library has met with great success, and it is well deserved, if the other books of the series are as entertaining as the present volume. This gives a brief *resume* of the general principles of the different schools of architecture, and under each a woodcut of one or two of the more prominent examples of the school. Beginning with the ancient Celtic monuments of the Druids, the reader in turn visits the ruins of Asia, Egypt, Greece, Rome, and the Roman Provinces. He sees the delicate tracery of the Moorish school, and learns of the heavy solidity of the Chinese wall or the rich sculpture which marks the former civilization of Central America. A little later and he is brought face to face with the beauties of the Renaissance as developed in Italy and France. Then he beholds the modern art of Paris, and finally the insular architecture of England. The limited space has permitted but a brief glance at such a wide range of subjects. It will, however, prove both interesting and instructive to those who have only a little time to devote to the subject.

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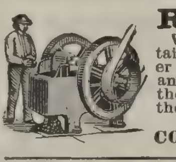

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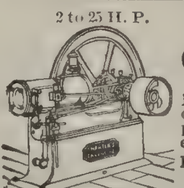

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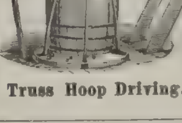

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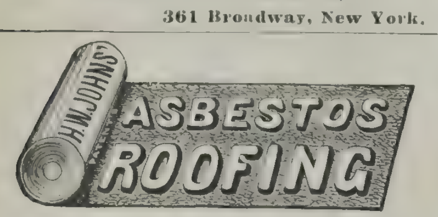

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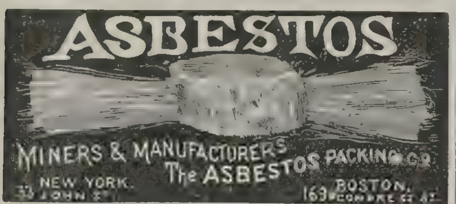

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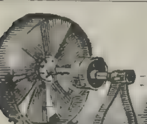

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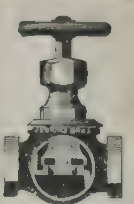

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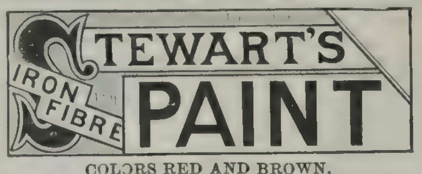

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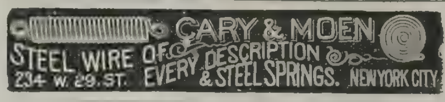

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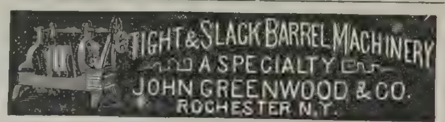

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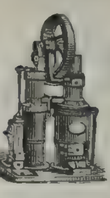

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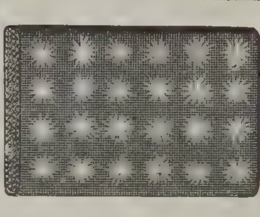

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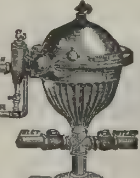

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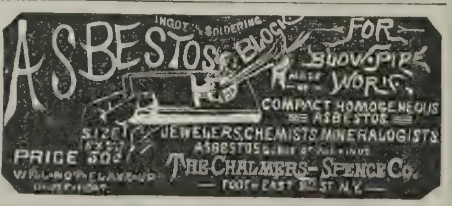

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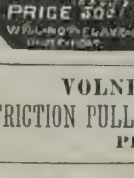

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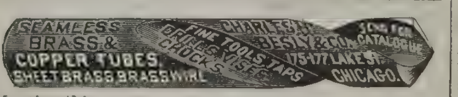

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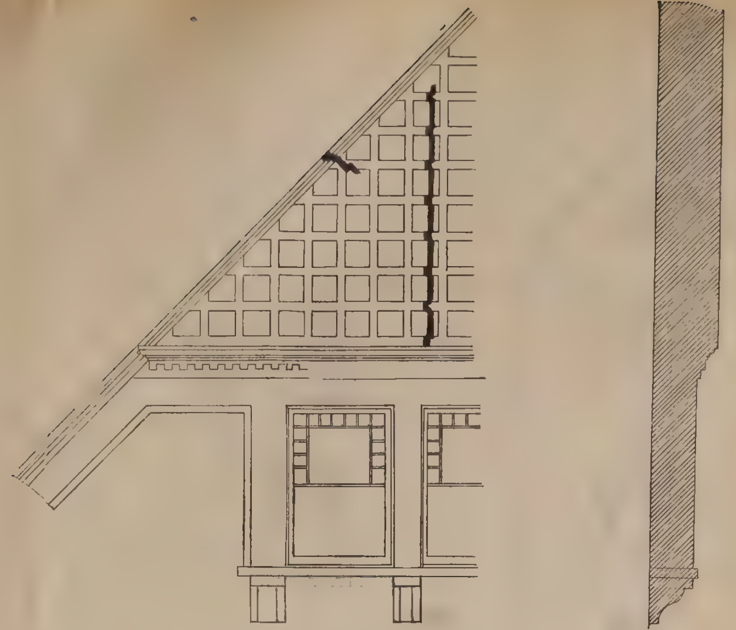

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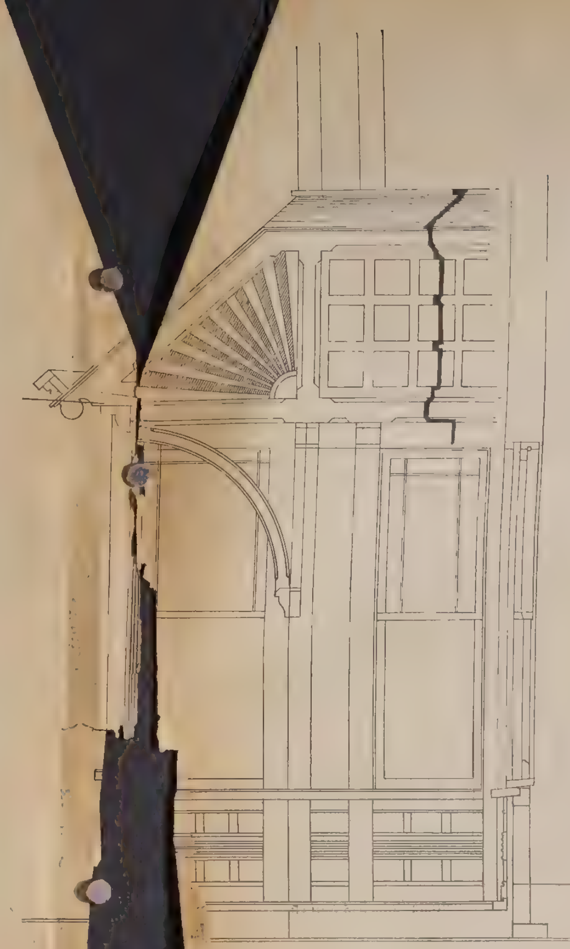

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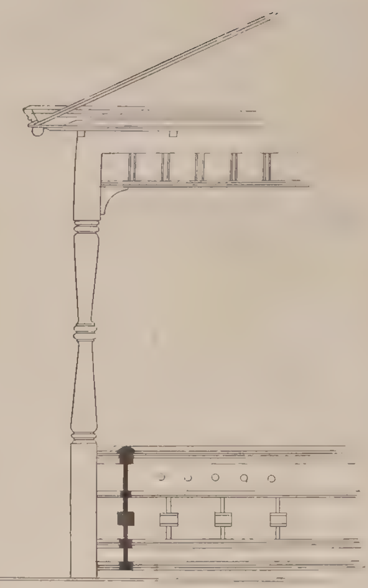

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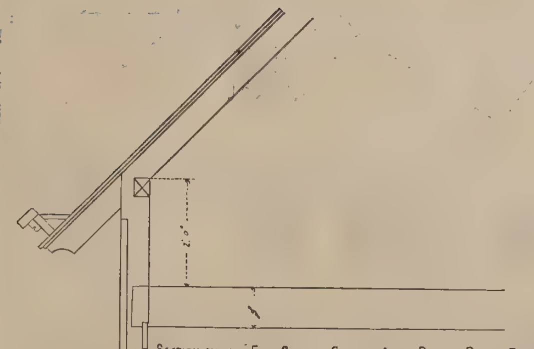

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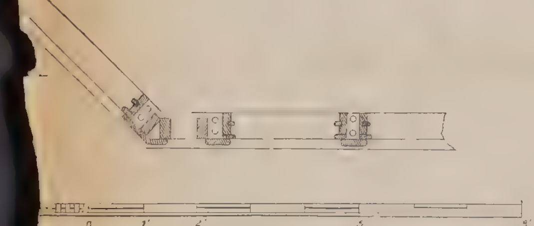

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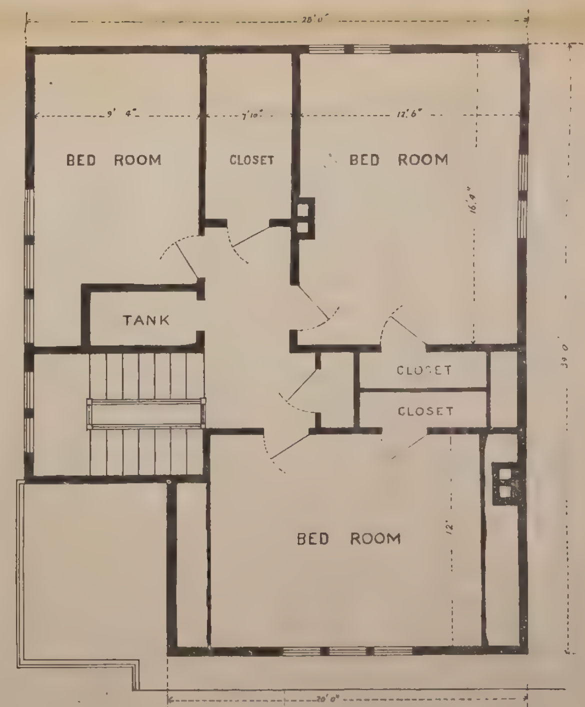

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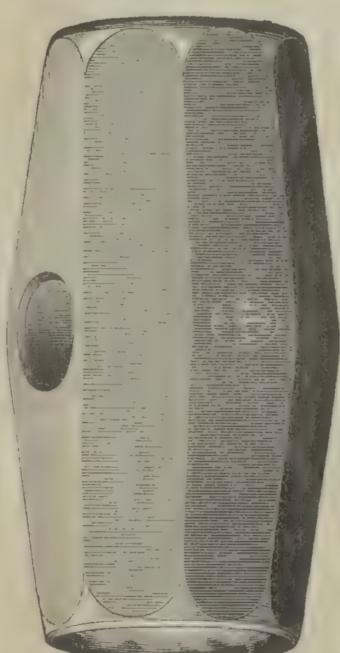

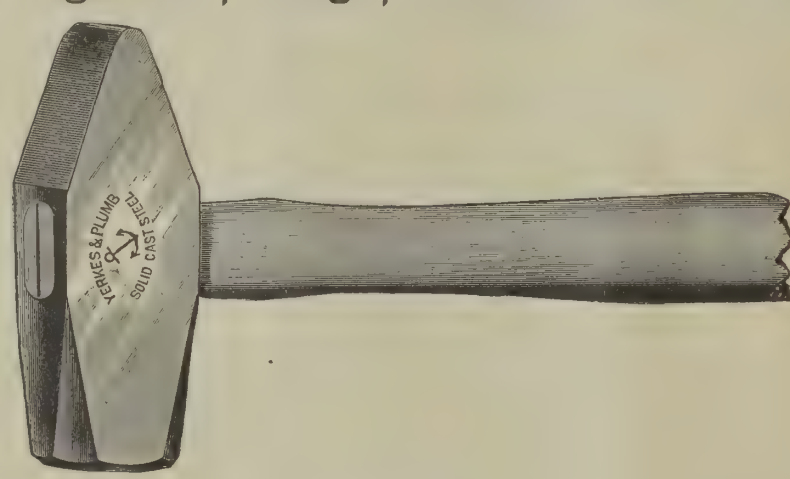

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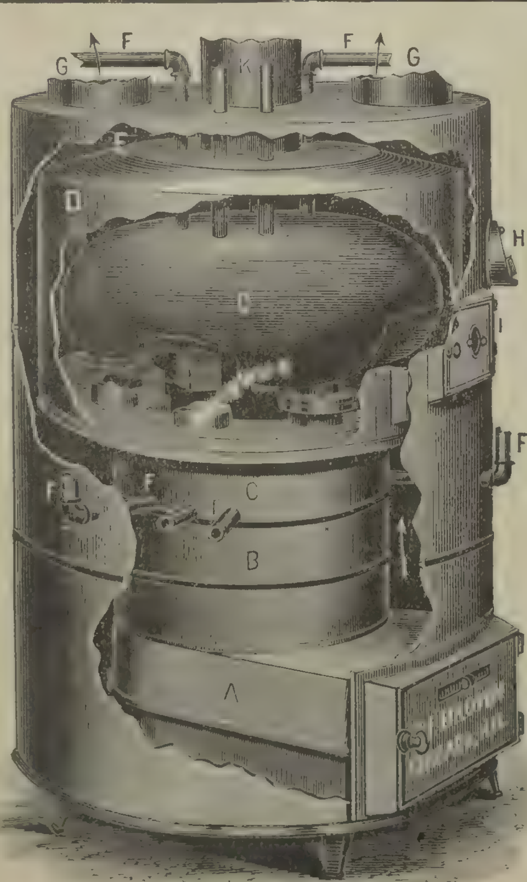

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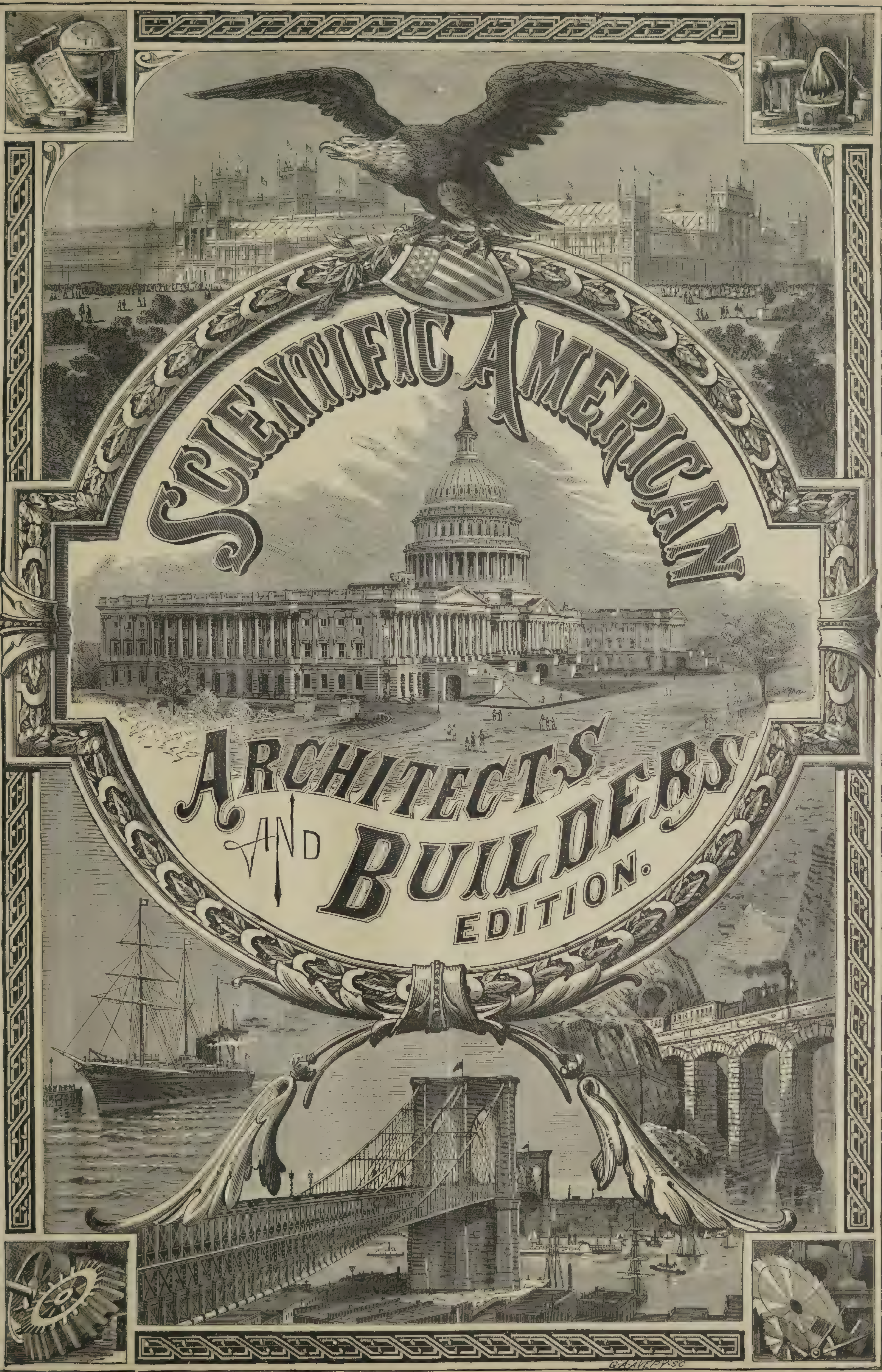

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SCIENTIFIC AMERICAN

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H. H. RICHARDSON.

In the death of Mr. H. H. Richardson, architect, which occured at Brookline, Mass., the last week in April, the architectural profession of the United States has lost a leading and representative member.

His works are among the most successful architectural productions of the day, and the influence of his skill and artistic ability is already nationally appreciated; and as imitation is the sincerest flattery, it can be said of Mr. Richardson that he has inaugurated a style, which is employed as a keynote and text of many an architectural composition by many an architect throughout the United States.

Had Mr. Richardson been spared the allotted time of the human race, and had he made as great progress in the years to come as in the past few years of his active practice and rapid development in his chosen style, it is safe to believe that he would have fully developed original ideas in architecture, especially adapted to our American requirements of practicability and artistic demands. Mr. Richardson leaves behind him architects who are his peers in artistic and constructional ability, yet who may not have implanted so strong an individuality in their productions as he has upon his work. He has left to the architectural profession a style which, if developed, or not, to the extent he might have carried it, will always be looked upon as having its origin with him, and his name will long be honored by the lovers and students of architecture in America.

The foregoing is from an editorial article in the *Building Budget*. A Boston correspondent of the same paper writes as follows:

So much has been written and so much said about Mr. Richardson, that I will only linger a moment over the interesting story of his life, before turning to the still more interesting record which he has left behind him in his works. His Southern nativity is, I fancy, to account for the more romantic elements of his artistic make up.

We are apt to lay too little stress in this country to the accidents of birth and early environment. An American is to us, first and most, an American, and it seems to make little difference in our estimate of what he is and does whether the snows of Maine or the sunshine of California influenced his childish imaginings and aspirations. The life of the boy Richardson in the old Southern city, surrounded by the quaint if not always beautiful sights of New Orleans, must have moulded his future to a degree which we can only guess at now. His parents were well-to-do people, not without prominence in the South. He was a grandson of Dr. Priestley, the discoverer of oxygen, and his natural gifts were developed by thorough education at home and abroad. When he came North in his young manhood, it was to enter Harvard College, where he graduated in 1859, in the class with the Rev. Dr. Brooks, the pastor of Trinity Church, the Rev. Dr. Alexander McKenzie, and Mr. Edward G. Hooper, the present treasurer of Harvard College. He spent seven years in Europe after his graduation, where he was strongly influenced by the Romanesque style, which he has done so much to popularize in this country. A large portion of his foreign study was in Paris, although he traveled on the Continent. On his return to America he opened an office in New York, where he remained until about ten years ago, when he came to Boston and established himself in the home at Brookline where he died.

The first work which Mr. Richardson undertook was the "North Church," at Springfield, Mass. It was in the struggling days of his early career in New York, not a great many years after his return from his long foreign study, when his design went into this competition. It is a rather severe little Gothic church, but is not unworthy of its architect's beginnings. At the time of his death he was engaged on the new wholesale store for Mr. Marshall Field, of Chicago, the new Chamber of Commerce in Cincinnati, the Pittsburg Court House, the interior of the Albany Capitol, and on several residences. It is noteworthy that in the work of this architect, who stood in the front rank of his profession in this country, we find this power of absolute simplicity contrasted with an exuberance of constructive imagination. No buildings more unlike can be conceived than the strong, plain, dignified Sever Hall, at Cambridge, and the romantic and striking Ames Memorial Town Hall, at North Easton, Mass.

There are a number of library buildings designed by Mr. Richardson which show his power of architectural reserve. The loveliest of these is the Crane Memorial Library, at Quincy, Mass., a building of which he was personally very fond.

TRINITY CHURCH, BOSTON, MASS.—H. H. RICHARDSON, ARCHITECT.

The Law School Building at Cambridge is an example of this architect's more elaborate and imposing work. It is somewhat exceptional to use light stone for trimmings on dark stone, but in this case it was done well, and the effect is certainly not unworthy the great man.

Of Mr. Richardson's more recent interior work on the Albany Capitol, Mr. Shepley told me that little has as yet been said outside of the Albany newspapers, and he showed me some pictures of the new Court of Appeals that filled me with enthusiasm, and made me long to make a special pilgrimage to Albany. Most lovely is the fireplace, of Mexican onyx and Siena marble, contrasting with the wainscoting of rich red and the dark carved oak of the Judge's desk, which reaches quite across the room.

No one who has ever seen Trinity Church, Boston, and has felt its charm, needs to read that it is right and strong, as well as characteristic. I have read somewhere that Trinity seems to have been suggested by the old Cathedral at Salamanca. It may be so, but it was a suggestion with an inspiration in it, and Trinity Church stands as the most individual and beautiful structure in America, and is the dead architect's best eulogy.

M. C. S.

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CONTENTS

Of the August number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

SEA-SHORE COTTAGE.

Some two or three years since, Mr. F. A. Roberts, architect, of the firm of Messrs. F. A. Roberts & Son, of No. 748 Broad Street, Newark, N. J., designed and built for himself, at Monmouth Beach, Long Branch, N. J., the admirable little cottage which we show in our colored plate, and in the elevations and detail drawings on our supplementary sheet.

The design is a good example of a well arranged sea-shore cottage, and is very tasteful in its conception and convenient in its arrangement. A reception hall or sitting room and hall combined is provided, in accordance with the prevailing custom in summer cottages of this class; and the wide expanse of piazza, the high pitched roof, and the extensive balconies, are all distinguishing features of this delightful form of residence.

The roof and sky lines, upon which so much depend in the general effect, are especially well managed, while the variety and harmony of colors, and the graceful contour of the outlines, are very satisfactory. Our readers will doubtless be glad to possess a design of so much merit.

In the construction of the house, the materials chosen have been of the usual type, but all of the very best description and quality. The brick piers and the chimney breasts are built in hard Jersey bricks, set in cement mortar, and the roof is covered with tiles and slates, with shingles on the gables, and a red tile cresting on the ridge. Pine is employed for the piazza, which is designed, as indeed all the details are, in a thoroughly substantial and ornamental manner.

The interior of the house is decorated throughout, excepting the stairs and hall ceiling, which are finished in yellow pine in a very attractive manner. The cost of the house as it stands was about $5,000.

The sheet of details for this cottage will be given with our next number.

RESIDENCE AT FLATBUSH, L. I.

The subject of the design illustrated in the colored engraving and in the detail and other drawings issued with this number is that of a compact little residence located on Ocean Avenue, Flatbush, L. I. It was erected a short time since for Lefferts Vanderbilt, Esq., from the designs and under the personal superintendance of Mr. H. L. Harris, architect, of 81st Street and 9th Avenue, New York city.

The cost of the house was $3,600, including a quantity of flagging, grading, etc., and everything required to completely finish the building ready for occupation. The design is to be chiefly commended for the successful manner in which an attractive elevation has been conjoined with a conveniently arranged plan at a moderate cost.

In this description of house considerable difficulty is generally experienced in obtaining anything like an original design. The extent of such houses is not sufficient to give scope for much variety in the treatment, unless it approach the eccentric, and originality in the design is therefore almost wholly confined to the interior finish. Where the object is to keep the cost of the house as low as possible, it is often the practice to purchase the joinery and interior fittings of a manufacturer, who generally sends out the stock designs in large numbers. It is partly for this reason that the interiors of such houses are as a rule so similar in appearance as to suggest the idea that they are turned out of the same mould.

In the case of this house the architect has very wisely taken the trouble to make special designs for the whole of the joinery and interior fittings; and, as will be seen from the examples we give, has handled the subject very effectively, with the result of considerably improving the appearance of the house as a whole and of giving it a pleasing and substantial aspect indicative of care and thought.

Following is the full text of the specifications used in the erection of the house, which show the materials employed, and will be useful to some of our readers as a guide in drawing up similar documents.

Mr. Harris has been very successful with this class of residence, as well as with others of a more extensive character, and is responsible for the designs of a number of dwellings at Flatbush and elsewhere.

SPECIFICATIONS.

Mason's Work and Materials.

Excavation.—Excavate to depths required for cellar walls, piers, cesspools, pipes, and any other work necessary to be excavated for.

Remove top soil and place on one side, and at completion of building use it in the final grading around it. Fill in and ram down tight with earth around all piers, pipes, etc.

Foundations for cellar walls, piers, etc., to be concrete, 4 inches thick, and 1 ft. wider than walls or piers resting on them. This concrete to be of Rosendale cement and clean sharp gravel. Build stone foundations for area steps and brick risers. Cellar walls, chimneys, piers, etc., to be laid up with sound Jersey brick laid in cement mortar, stopped up from concrete with footing courses. Cover outside of foundation walls with a heavy coat of pure Rosendale cement from foundation to surface of ground at grade. The walls and piers above ground, the laundry fireplaces, and chimneys above roofs, to be faced with good quality North River hard burnt brick laid in cement under mortar joints and struck smooth. All cement mortar used to be 1 part cement, 1 part lime, and 8 parts sand. Kitchen fireplaces to be faced up with Philadelphia pressed brick laid in white mortar. Form fireplaces where shown with 8 inch by 8 inch smoke flues, with joints struck smooth and full without pongetting. Furnace flues to have a round 6 inch fireclay pipe to extend from cellar to a point 4 feet above second story beams. Turn trimmer arches, set cellar window frames, and form all other brickwork necessary to complete the building.

Cesspools.—Build up with dry stone walls 18 inches thick a cesspool, 6 feet inside diameter and 18 inches deep. Draw in at top, leaving manholes to be covered with bluestone. Cesspool to be 20 feet from rear of building.

Drain Pipes.—Lay 5 inch heavy glazed earthenware pipes from houses to cesspools, the joints to be laid tight with cement and well blocked up with stone. Also coal slides of heavy glazed earthenware pipes, 16 inches in diameter, as shown on plans.

Bluestone.—Furnish and set the following of North River bluestone: A piece 16 inches square, hollowed out, and 4 inches thick, common axed, for each leader to discharge upon. Cover for cesspool 4 inches thick, with four 1¼ inch holes drilled through it.

Cellar window and door sills 3 inches thick, common axed. A stone 1 foot square, 4 inches thick, for each post in cellar. Area steps 3 inches thick, axed. Area coping 3 inches thick, common axed. Chimney caps (with flueholes) 3 inches thick, common axed on edge. Lintels over kitchen and laundry fireplaces 10 inches high, 3 inches thick, rubbed. Rubbed hearth in kitchen 3 inches thick, bedded in cement.

Stone 2 ft. 4 in. × 2 ft. 4 in., and 3 in. thick, with hole for coal slide, common axed.

Flagging.—Four feet wide from front steps of both houses to meet flagging of sidewalk and also 180 odd feet running from northerly end of the owner's lot on Ocean Avenue to the curb on Lincoln Road.

Furnish cast iron coal slide cover with strong chain and fastening complete.

Concrete in Cellar.—Cellar and laundry floors to be covered with gravel and cement concrete 3 incnes thick, and finished on top with a mixture of Rosendale cement and sand, 1 of cement to 2 of sand, laid 1 inch thick. To be warranted one year.

Filling in, Grading, etc.—The space formed by slope of bank on the owner's lot to be filled in with earth and gravel level with owner's lot. The entire property to be plowed up, all stones cleared off, and the whole harrowed down level and sowed with first-class grass seed in best manner, leaving roadway by the house as may be directed. Cart away all stones and rubbish.

Lath and Plaster.—Lath all walls, ceilings, soffits of stairs, etc., in first and second stories, the walls of landing in cellar, with sound laths, well nailed ⅜ inch apart, breaking joints every 16 inches. Plaster all first and second story work 3 coats; 1st and 2d coats, 1 of lime to 4 of sand, with plenty of well whipped goat's hair; 3d coat in kitchen pantry and second story, hard finish; 3d coat in parlor, hall, and dining room to be a fine sand finish, using sharp, fine white sand and no plaster. Laundry and W. C. walls to have a rough coat and then a slip coat. All walls to be plumb and true, and ceilings level.

Cornices.—Run plaster cornices in dining room, parlor, and first story hall. Set plaster centers where there are drop lights; to be 16 inches diameter, plainly moulded. Four transoms where shown, with moulded brackets at foot and rule joint on arrises. Also run rule joint on arrises of chimney breasts and any other angles of plastering, as directed.

Make good any broken or imperfect places in plastering or brickwork at completion of buildings, and clean out and cart away from premises all dirt and rubbish left from the mason's portion of the work; clean down all exposed brickwork.

Carpenter's Work.

Timbers.—Beams, studs, roof timbers, etc., to be of spruce, sound, dry, and free from defects.

Sizes 1st floor beams .... 3 in. × 8 in.—16 in. from centers.
" 2d " " .... 3 in. × 8 in.—16 in. "
" Attic " " .... 3 in. × 7 in.—18 in. "
" Piazza " " .... 3 in. × 7 in.—18 in. "
" Sills " " .... 4 in. × 6 in.
" Plates " " .... 4 in. × 4 in.
" Studs 2½ in. × 4 in.

Girders in cellar 6 in. × 8 in., rafters 2 in. × 6 in. and 2 in. × 8 in., ridges 1 in. × 8 in. All other timbers of sizes designated by architect.

Framing.—Sills halved together at corners, 1st story beams notched on sill; 2d story and attic beams to be notched on a 1 in. × 6 in. girt let into studs flush with inside. All floor beams used as headers or trimmers to be 4 inches wide. Beams well spiked at every mortise. Bridge each tier 2 rows of bridging of 1 in. × 3 in. stuff, 2 nails each end.

Studding.—Set studs 16 inches from centers, with

sole and cap pieces, and 1 row bridging studs, to be doubled at door and window jambs and at angles. Truss over all double door openings.

Roof.—Frame roof in the strongest manner, rafters 18 inches from centers, and the whole well braced and spiked. Rafters of piazza and roof of balcony to be exposed, planed, and chamfered. Posts in cellars to be 6 inch rough chestnut.

Outside Covering.—Walls and roof to be covered with 1 inch hemlock boards, tongued and grooved and planed one side. To be laid diagonally on walls. Cover roofs and sides with heavy resin-sized building paper, sheets well lapped and secured. Corner boards, fascias, window trimmings, etc., to be 1¼ in. thick, 4 and 5 inches wide as directed, all of white pine. Clapboards to be beveled, and laid 4½ inches to the weather, and shingles on sides to be common pine shingles laid 5 inches to the weather.

Roofs to be covered with cedar shingles. Gutters to be formed as shown on elevation, and to be lined with tin. Leaders to be 3 inch galvanized iron with offset at foot. Flash with tin around chimneys, valleys, etc., top of all horizontal caps and sides of building where roof joins it.

Cover 2d story balconies with tin. All tin used for gutters, roofs, or flashing to be the best I. C. charcoal tin, painted two coats and allowed to dry before using. Sheathe up the ceiling of piazza of No. 2 house with 3½ inch wide pine, matched, beaded, and planed.

All trimmings and ornamental work, mouldings, rails, etc., on outside of building to be as shown on elevation of white pine. Piazza posts 6 in. white pine turned, with square tops and bases. Balcony roof posts 4 in. square pine.

Fences.—Build fence as design, with two carriage gates and two smaller gates, with strong hinges and catches.

Piazza Floors.—To be 1 inch white pine 4½ inches wide, tongued and grooved and planed one side.

The roof boards of piazzas and balcony to be 1¼ inch, 3½ inches wide, tongued, grooved, and beaded, planed one side.

Piazza steps 1¼ inch white pine, risers 1 inch. Rear steps and risers 1 inch. All steps to have coves and nosings.

All work to be as architect's details.

Inside Work.—All inside work to be white pine unless otherwise specified. To be clean, sound, and dry.

Floors.—First story except kitchen to be 1 inch pine, tongued and grooved, planed one side, 4½ inches wide. Kitchen yellow pine 4½ inches wide. Attic floors to be roofing boards, same as that used for roof. All floors blind nailed, and to be good quality stuff. Furr off laundry and W. C. brick walls with 1 inch × 1½ inch furring. Set grounds for plastering. Furnish centers for arches.

Window Frames.—Cellar frames to be 1½ inch stuff, rabbeted for sash and covered with galvanized wire netting. Box frames to have 1 inch pulley styles, 2 inch sills, ½ inch parting strips, and 1½ inch stop beads.

Door Jambs.—One inch stuff with ½ inch strips to form rabbet. All door saddles and hearth borders to be of ash.

Sashes.—All sashes to be 1¼ inch pine, hinged in cellar and attic, and double hung in other windows, except stained glass windows, which will be stationary. All double hung sashes to have best cord, pulleys and weights, etc. Sash divided as shown. The sashes over bath room doors to be transoms, hinged and buttoned.

Blinds.—All windows in parlor, dining room, and rooms in main part of house which open to the south and west to have Hill's inside blinds. The frames for these windows to have no stop beads, but space 4 inches wide to be left from sash to plaster, to receive a stop bead. Allow $130 for these blinds. All other windows to have 1¼ inch outside blinds, with rolling slats and strong hinges and fastenings open and shut. Put outside blinds to all blank windows.

Doors.—All doors except closet sliding and front outside doors to be 1½ inches thick, 4 panels, with flush mouldings both sides. Closet doors 1¼ inch, 4 panel, flush mouldings outside. Outside front doors 2 inches thick, with raised mouldings outside and flush mouldings inside, panels as shown. Sliding doors 2 inches thick, 4 panels, flush mouldings both sides. Sash doors where shown to have 4 lights. Double doors between parlor and hall will be furnished with hardware, stained and finished, and left in attic in good order.

Trim.—1st story trim to be 4½ inches wide, ⅞ inch thick, beaded, with corner and base blocks and wall mouldings; corner blocks to have turned rosettes, windows to have panel backs, panels flush moulded. Base 8 inches high, with 2 inch mould. Second story trim to be same as first, excepting that there are to be no base blocks or wall mouldings, windows to have sills and aprons. Base 7 inches high, same as first story. To be a 2 inch picture mould around parlor, dining room, and hall in first story. All trim, doors, etc., to be extra clear white pine, as they will be stained.

Stairs.—Main stairs to have 3½ inch × 3 inch cherry rails, with 6 inch turned cherry newels and 1½ inch turned pine balusters. Treads to be 1¼ inch, with cove and nosing. Risers 1 inch, strings, fascias, etc., 1 inch beaded. All pine stairs to be strongly timbered, housed, glued, and left secure. Cellar stairs to have treads and strings of 2 inch rough plank planed on top, no risers. To have plain hand rail and supports. Stairs to attic to be box stairs, 1 inch treads and risers, with pine hand rail.

Fittings in Laundry.—Fit up two wash trays of 2 inch clear pine, joints put together in white lead. To have clamped lids, four 1 inch holes through each, and turned legs.

W. C. in cellar to have seat, lid, riser, etc., of 1 inch pine; seat and lid with brass butts; all put together with screws. Trim laundry windows and doors.

Coal Bins.—Fit up, with studs and roofing boards, two coal bins, as directed by architect. Make cold air boxes with dampers of 1 inch pine. Build bulkheads over cellar steps of 1 inch pine, double hinged doors.

In Kitchens.—Fit up sink, with draining shelf of yellow pine wainscot 6½ feet high back of sink and boiler, and 3 feet 6 inches high all around kitchen, with white pine not less than ½ inch thick, 2½ inches wide, tongued, grooved, beaded, and planed, with 2 inch mould for cap.

In Butler's Pantry.—Fit up lockers with shelves and paneled doors, from counter shelf to ceiling, with cap mould. To have 3 drawers and cupboard, with shelf under counter shelf. All closets throughout to have shelves of 1 inch pine, with beaded edges and strips for hooks, placed where the architect may direct. Put locker and shelf in back porch.

In Bath Room.—Wainscot all around with yellow pine 2½ inches wide, ½ inch thick, tongued, grooved, beaded, and planed, with 2 inch moulded cap. Bath tub casings and batten door under basin the same as wainscot. Top of the tub 1 inch yellow pine.

W. C. to have yellow pine seat, lid, and riser; seat and lid to be clamped and provided with brass butts. All put together with screws, so as to permit of its being readily taken apart. Case in all exposed pipes in kitchen with pine 1 inch thick, using screws.

Mantels.—Allow $30 each for parlor and dining room mantels, to include hearth, grate, etc., complete. Furnish and set in each second story front room a pine mantel, with moulded shelf, bed moulds, beaded pilasters, moulded bases, etc., with a slate hearth. The register will be set in brick and plaster in this fireplace.

Finials.—Furnish iron finials as shown, to cost $2 each. To be set in turned bases of chestnut, and secured to roof as architect directs.

Clothes Posts.—Set four turned chestnut clothes posts at rear of yard, as will be directed.

Hardware.—First story front outside doors to have 5 inch mortise lock, with night attachment, brass face plates, keys, etc.; knobs, drop, roses, bell pull, etc., of bronzed iron; 5 inch loose pin butts of bronzed iron, with ornamental face. All other first story doors, except sliding doors, to have 3½ inch black japanned butts, plain with acorns, and 4½ inch mortise locks, with brass face plates and keys, and white porcelain knobs with japanned shanks, and with porcelain drops. Sliding doors to run on brass tracks, with iron shears, and to have japanned flush pulls and locks. Second story doors to have 4 inch mortise locks, with brass face plates and keys. Knobs and drops white porcelain. Butts same as first story of cast iron, not japanned. Doors in cellars and laundry to have corner mineral knobs, with rim locks and brass keys. No two keys to be alike in the house. Put bolts on bulkhead doors. Doors in pantry to have 2½ inch black japanned butts or brass locks, with iron keys. Drawers to have pulls to match japanned butts. All hinged windows in cellars to have cast-iron 3 inch butts and strong buttons, and French window in second story to have butts to match doors, and a flush bolt top and bottom, and white porcelain knob. All first and second story windows to have common fasts to match other hardware. Put double black japanned clothes hooks in all closets in second story, as architect directs. Furnish all other necessary hardware.

Bells.—A 4 inch gong to be fitted in kitchen to ring from front of house, and a swinging bell in kitchen to be rung from 2d story hall.

Furnaces, Ranges, etc.—Provide and fit up complete a portable furnace with galvanized iron casings of sufficient power to heat the rooms to 70 degrees in coldest weather. Registers to be black japanned where shown, with tin pipes leading to them. Registers to have slate borders and tin boxes, and set in plaster of Paris. Put iron lathing on both sides of pipes in wood partitions, and line studs both sides of pipes with tin. Also put iron lath in rear rooms, 2d story, 3 feet 6 inches × 4 feet, where marked. Put a black japanned iron cellar and corner fluehole, 2d story, rear rooms. Put a damper in each heat pipe at furnace. Range to be a 3 foot, cast iron, brick set range, with at least six 7 inch holes, water back, etc., set complete.

Painter's Work.

All outside wood and brick work, including roofs, to be painted three coats in four or five colors, according to architect's designs.

All inside woodwork in laundry and second story, except bath room, to be painted three coats, in two colors, or stained cherry in second story, as described. In kitchen and bath room, woodwork to be stained a light tint. All other first story pinework to be stained cherry in best manner, after filling floors of parlor, dining room, hall and pantry. Kitchen floor to be oiled. Putty up and sandpaper down before last coat is put on. Cellar walls and joists overhead, under side of first story floors, etc., in cellar and laundry to be whitewashed one good coat.

The parlors, dining room, and 1st story hall walls and ceilings to be well sized with glue sizing, and kalsomined in best manner. Walls with frieze above picture mould, cornices, and center pieces be tinted in kalsomine, tints being selected by architect.

All white lead and linseed oil to be pure, and the whole of the work done in the best manner.

Glazier's Work.

All glass, except where specified below, to be good quality, double thick American glass, set in putty with metal tacks. Sash divided as shown. Diamond windows at end of hall to have lights of plain colored, rough cathedral glass, worth at least $4 for the whole window. To be selected by the architect. Put plain glass in sash door at rear of kitchen and in transom over bath room door, and ground glass in doors at back of 1st story hall.

Plumber's Specification.

Fixtures.—Sinks.—In kitchen to be 1 foot 4 inches × 2 feet 4 inches cast iron sink, with strainer and with cast iron legs, and plain back with brass flange, and thimble cock with hose end in cold water cock.

Boiler.—To be a 30 gallon galvanized iron boiler on plain stand; to have ¾ inch sediment cocks, ½ inch stop and waste cock on cold water supply. Sediment pipe to be ¾ inch. A lead pipe to discharge into trap of kitchen sink.

Bath.—In bath room a 5 foot 14 oz. tinned and planished copper bath tub, with overflow and nickeled combination cock, plug, chain, etc.; 12 inch Wedgwood ware basins, with overflows, nickeled plug, chain, and turn-round cock. Basins to have Vermont marble slabs, countersunk and moulded, and base 8 inches high. Basins secured to slabs with brass clamps. Water closets to cost $15 each, of a pattern selected by architect, to be fitted up complete with 4 inch D lead traps and screws. To have cistern if desired. The wash trays in laundry will be wood, furnished by carpenter. To be fitted up with brass flange and the compound pressure cocks, strainers, plugs, chains, etc., complete. To be provided with overflows.

W. C. in cellar to be an enameled iron hopper, flushing rim, supplied from street pressure, with 4 inch D lead trap and screw, all fitted up complete. All fixtures, except W. C., to have hot and cold water. Put stop and waste cock on supply just inside cellar walls, and a supply to cut off second story fixtures, making the system complete for draining all pipes in the house.

Water Supply.—Take a ⅝ inch tap from street main, paying for all permits, etc., and run a 3 lb. per foot ⅝ inch lead pipe from traps to inside cellar walls; there connect with a ½ inch galvanized iron pipe, and run up to kitchen; from thence take ½ inch branches of two A lead pipes to supply all fixtures except boiler, which is to be ⅝ inch 2 A lead pipe. Take from boilers a ½ inch 2 A lead pipe, with ½ inch 2 A lead branches, to supply all fixtures. Connect boilers with water tanks with a ¾ inch 2 A lead pipe. All overflows to be connected with waste pipes of fixtures. All lead joints wiped with solder, and all connections made perfect.

Waste Pipes.—To be 4 inch, tarred, cast iron waste pipe, to run from earthenware pipe up through bath rooms and through roofs, where they are to be provided with ventilating caps, with lead flashing at roofs. These pipes to have 4 inch cast-iron running traps just inside cellar walls, with handholes and covers, and vented through a 3 inch cast-iron pipe, to run to surface of ground at buildings, and extend 6 inches above ground, with ventilating caps. Make W. C. and connections with 4 inch soil pipe by means of a 4 inch D lead S trap, with screws; trap of W. C. to be vented through 2 inch D lead pipe, that from cellar W. C. to run into vent from main 4 inch trap, and that from bath room W. C. to run into main soil pipe from above fixtures.

Sinks, wash trays, basin, and bath tub to waste through 1½ inch D lead S traps.

All connections of lead with iron pipes to be made with brass ferrules.

Safes.—Put 3 lb. per foot lead safes, edges turned up 2 inches, under bath tub, basin, and W.C. in bath room, with waste of ¾ inch D lead pipe to discharge on cellar floor. Safes to have brass strainers. All joints of iron pipes to be filled with oakum and hot lead, and well calked. Apply the peppermint test if desired.

Gas Fitting.—Connect in each house with meter, a pipe of proper size with shut-off cock as it leaves meter.

From this run branches of proper sizes to all outlets. Outlets securely capped. Ceiling outlets 8 inches below ceiling.

All pipes to be wrought iron, firmly secured in place with iron hooks, hinges, straps, etc. Test pipes with ether. The plumber is to furnish all materials mentioned in the foregoing, and the said materials are to be the best of the kinds specified. All work to be executed in a first-class manner, joints made tight, and the whole system of drainage and supply to be perfect in every respect.

The whole of the materials referred to in the foregoing specifications are to be new, and the best of their several classes, free from all imperfections. The whole of the work is to be executed in a sound and workmanlike manner, and completely finished, in all respects, to the entire satisfaction of the architect, whose decision on all matters connected with this contract shall be conclusive and binding on both owner and contractor.

THE WAINWRIGHT SYSTEM OF STEAM HEATING.

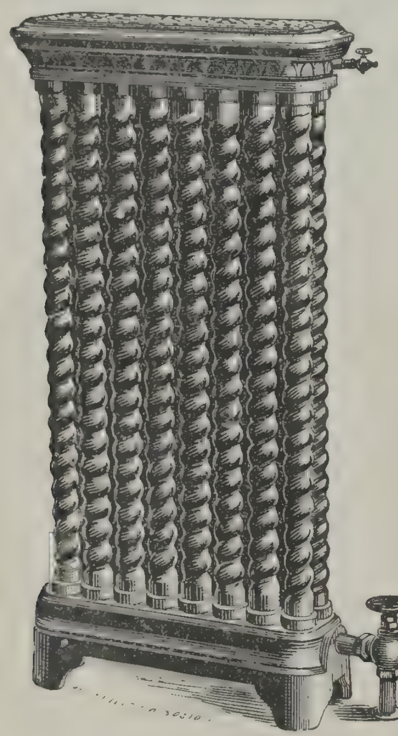
The question of domestic heating attracts each year increasing attention, for one of the first conditions of comfort is the maintenance of an agreeable temperature during all seasons of the year. The convenience and easy regulation of heating systems depending upon steam or hot water soon made them popular for use in public buildings and offices, but their introduction into dwelling houses has been somewhat more tardy, on account of the large first cost of the apparatus, and still more perhaps on account of the unattractive shapes given to the radiators. But there has recently been a great improvement in both of these respects. The boilers are now self-regulating and much less expensive than formerly, while the radiators are made very pleasing in appearance.

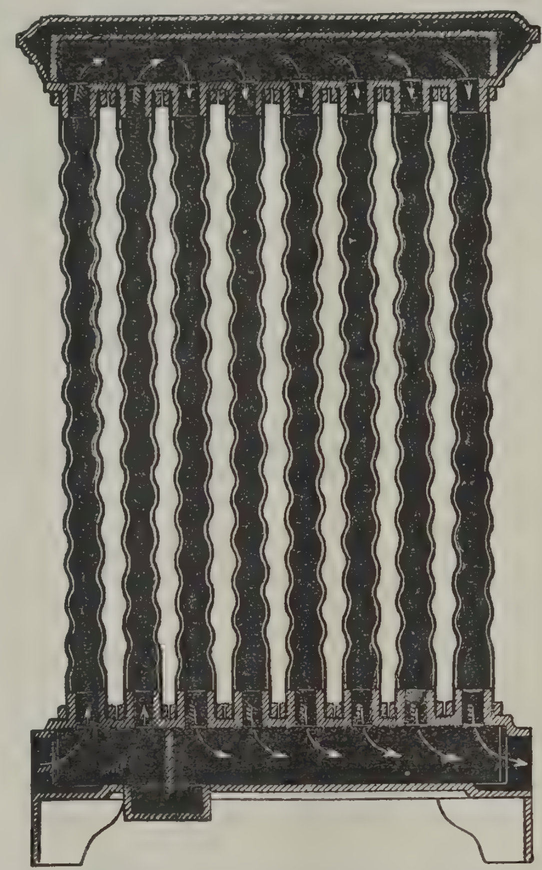
Among the most attractive forms which have been introduced in response to this artistic demand are the corrugated tube radiators made by the Wainwright Manufacturing Company. Their general appearance and construction are shown in our illustrations. We have already spoken in a previous issue of the manufacture of these tubes and their use under different conditions, but their particular applicability for purposes of radiation deserves special mention.

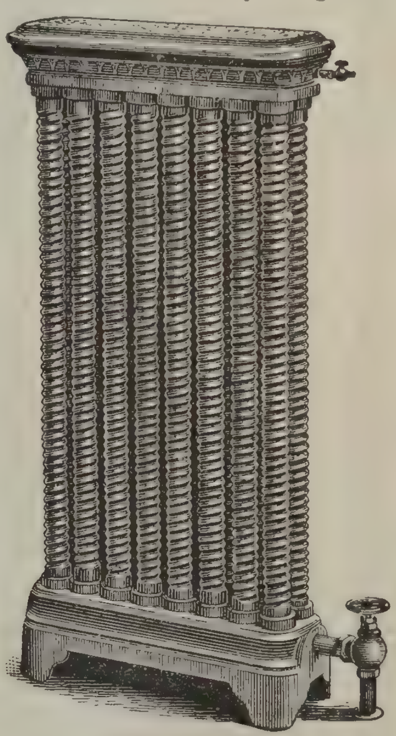
The radiators are intended for use with steam or hot water, and are arranged for either the single or double pipe system. They are all tested up to 100 pounds pressure before being allowed to leave the works. The tubing is seamless throughout, and is made of thin copper or brass. The corrugated form increases the amount of actual heating surface, and at the same time strengthens the tube. In consequence, it is permissible to use very thin metal, by which quick radiation is obtained and the efficiency of the system largely increased. Carefully conducted experiments made on the corrugated and the iron pipe radiators have demonstrated a decided advantage in favor of the former. On account of this greater efficiency, a room may be heated with a much smaller radiator. It will be noticed that the tubes are corrugated both inside and out, and therefore the whole surface is presented to the action of the steam or hot water, in place of a simple addition being made to the exterior. Further, the corrugation is spiral instead of annular, and has perfect freedom for expansion and contraction.

The radiators are well arranged for circulation and drainage, and by reason of the thinness of the tubes, cool quickly when the steam is shut off. They are made in several sizes, and, owing to the corrugated tubing used in their construction, form an agreeable feature in the furnishing of an apartment.

The offices of the Wainwright Manufacturing Company are at 65 and 67 Oliver Street, Boston, and at 93 Liberty Street, New York. The factory at Medford, Mass., is now being enlarged to meet the demands of an increased business. A four story building, 31 by 78 feet, is in course of erection, and when completed will contain a machine shop and corrugating and radiator departments. The former building has been moved, and will also be utilized as a machine shop. These changes will increase the capacity of the works three or four times, and permit the company to fill its accumulated orders







THE WAINWRIGHT CORRUGATED TUBE RADIATORS.

Asphaltum in Building.

The use of asphaltum in building has become quite general. It is principally employed as a prevention against damp cellar walls and mason work under ground, also for water-tight cellar floors, coating for rain water cisterns, covering for underground vaults, etc. The usual method of applying it is to reduce to a semi-liquid state, in a large iron pot, over a good fire. The wall is made as nearly dry as possible, and the joints somewhat rough, to admit of the asphalt penetrating the pores and securing a hold; the wall is then covered with asphalt applied with a brush while the material is hot, and brushed in well—a coating one-half inch thick being as perfect a protection as a thicker one. A barrel of asphalt, as found in the market, heated and applied to vertical walls of brick, will ordinarily cover about two hundred and fifty square feet of surface, and produces most lasting results. Care must be taken in heating the asphaltum that it does not boil over the vessel and ignite.

Practical Hints to One Contemplating Building.

Before the contract is signed, ascertain the exact location of the house, so that you may know just how much the excavation will be. It often happens, when this precaution is not taken, that there is more excavation than ordinary, and the contractor will refuse to do the work required, without extra pay; and rather than have an extra, the house is located either too low or too high from the street—an error that can never be corrected except at considerable cost.

To ascertain the exact excavation, it is necessary first to know the *grade of the sidewalk*, and from this measure back the distance desired from the street line, allowing a fall to the street for the water of not less than one inch to three feet. This will give you the grade line at your foundation wall, and the excavation will thus be easily calculated, as the wall is usually 2 ft. 6 in. above the grade, and as much below as the cellar is required deep, allowing three inches for concrete on cellar bottom. Having fixed the distance of the house above the street and its elevation above the same—see to it that the top soil is carefully removed at such a distance from the house as not to be covered up by the poor soil when thrown out, and in such deposits as to be most convenient for top covering when ground is finally graded. This precaution will save moving dirt unnecessarily. The poor soil should be thrown out and deposited far enough away from the wall so as not to be in the way of the carpenters, or act as a dam to keep the water from running away from the building. As much of it as possible should be deposited where it is wanted to remain. Handling dirt twice over is expensive, and this generally falls upon the owner, if inexperienced.

The specifications generally call for a trench to be dug under the wall a few inches wider than the wall itself and 8 to 12 inches below the cellar bottom. This trench to be filled with concrete of which the wall is to be built. This is a very important matter, as upon a *good foundation* depends the stability of the house. It too often happens, however, that the contractor hurries over this part of the work, as he can easily escape detection by putting in but three or four inches of concrete only of the width of the wall. If this work is done in the late autumn, the inside of foundation wall should be well banked up with earth to keep out the frost.

Builders' Hardware and Tools.

One has only to examine a modern, well-built house, or to glance over one of the handsome trade catalogues issued by the principal manufacturers or dealers, to appreciate the immense advance made during the past few years in the department of building hardware and accessories. We have before us now a very handsomely illustrated catalogue issued by Messrs. Chas. A. Strelinger & Company, of Detroit, Mich., in which there is much to attract those interested in the building arts. The stock of hardware carried by the firm is very extensive, and so complete that their catalogue might well serve as a list of what has been accomplished in this direction. It has been the endeavor of the firm to let no desirable article manufactured escape their attention, and at the same time to limit their stock to the very best grade of goods, such that they can recommend for quality in material and workmanship. It is the practice of the house to offer their services personally in the selection of the requisite trimmings, where their customers are unacquainted with the intricacies of builders' hardware; or, where a description and plan of the contemplated building are sent to them, with an approximate detail and figure, they are quite willing to submit a specification of the hardware required, with an estimate of the cost. With this assistance and that offered by the fully illustrated catalogue, it becomes quite as easy to accomplish one's shopping in this line of goods as in others that are more familiar. Handles, hinges, locks, and, in fact, everything necessary for doors and windows and furniture, are found in such attractive forms that they can well afford to be made a feature of the decoration, in place of being chosen simply for their unobtrusive usefulness. In stable fittings, also, the list of convenient devices is large enough to make it a strong temptation to have the stable a very complete affair.

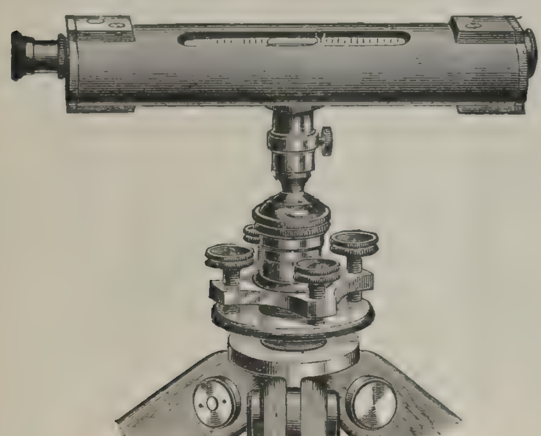
The same firm makes a specialty of tools and supplies for workers in wood and metal, and the catalogues issued in these departments are similarly complete and attractive. One is almost surprised to find that there are so many tools in the market; and unless he be a practical man, he would certainly be at a loss to account for the use of some of them. The stock described in these catalogues represents the goods of many of the best manufacturers in the country. Here, also, the system of fully illustrating the text is a great advantage, for it enables the purchaser to obtain an excellent idea of what he is ordering.

Acid pulp for paper making is produced in Sweden at a cost of one cent per pound. The labor is mostly performed by women, whose wages are from twelve to twenty cents a day.

DRAINAGE LEVEL FOR BUILDERS.

For many years Messrs. W. & L. E. Gurley, of Troy, N. Y., have been well known as the manufacturers of surveying instruments, and have brought out many special forms possessing decided excellence.

The drainage level which we illustrate is particularly suitable for builders and others who require accurate levels, for either constructive or hydrographic purposes. The instrument is simple and efficient, and its price very moderate. The oval brass case containing the level and telescope is 9 in. long, 2 in. wide, and 1¼ in. high. It is provided on its under side with a small socket, fitted to a ball spindle, by which it is made approximately level. The more delicate adjustment is made by the small leveling screws as shown. The in-



DRAINAGE LEVEL FOR BUILDERS.

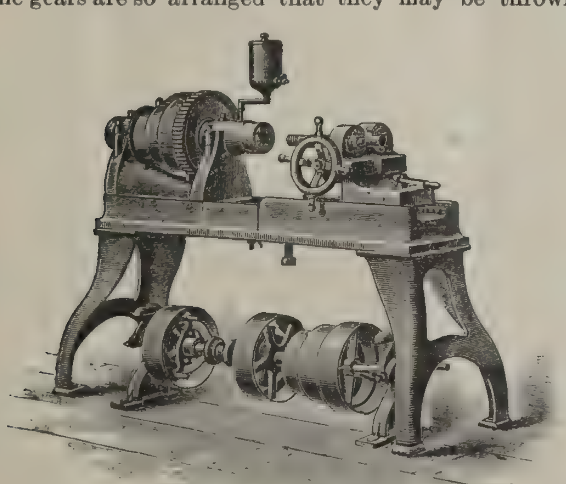
strument is easily adjusted. By reversing the spirit level from end to end on the lower faces of the case, any needed corrections may be made by the two screws in line with the level tube; and by applying the opposite faces to the same surface, the cross wires in the telescope may be made to cut the same point in both positions of the case by means of the two adjusting screws.

By the help of this little instrument drains can be located and leveled, and the lines for shafting, floor timbers, and sills be determined with precision. When the level is removed from its socket, it can be applied either by itself, or on a straight edge for leveling surfaces in the ordinary manner. If desired, a compass is added, removably attached to the upper surface of the case, and thus equipped, the instrument serves for determining the bearings of lines, and for measuring angles. The level is mounted on a jacob-staff, plain tripod or, as shown in the engraving, on a tripod with leveling screws.

SCREW CUTTING MACHINERY.

The Bolt Cutter, Nut Tapper, and Pipe Threader shown in our illustration is manufactured by the Wiley & Russell Manufacturing Company, of Greenfield, Mass., whose patent screw cutting and other labor-saving machinery and tools are so well known in the market.

The machine is made with hollow spindle, the hole through which is 2½ inches in diameter. The vise is adapted to properly hold the various sizes of the pieces to be operated upon, and to take work of irregular shapes. The back gearing is made very powerful, and the gears are so arranged that they may be thrown



BOLT CUTTER, NUT TAPPER, AND PIPE THREADER.

out, as in an engine lathe, for small work, and also in running back after cutting screws

The countershaft of the bolt cutter is run at about 125 revolutions a minute. The patent friction pulleys employed are entirely noiseless, smooth, and easy in their operation. Each pulley is made with two right and left screws, of very steep pitch, which apply the friction effectively at the touch of the operator, and release the pulley immediately upon the reversal of the action.

This construction prevents them from sticking or slipping. They are readily adjusted, and cannot work loose. Assortments of taps, dies, and collets are furnished with each machine, varying in their range according to the wishes of the purchaser. The patent adjustable dies made by this company are in two pieces, accurately and securely held together by screws, and possess many advantages over the solid die, or those made with a single opening, and depending upon the spring temper of the metal to permit the wear to be taken up.

Large numbers of these dies have been in use as much as seven years without needing renewal. Properly treated, a die will frequently thread from fifty to eighty thousand bolts, without requiring attention. They are readily fastened in their collets by side screws. The taps for cutting internal threads have a corresponding range in their diameters, and, like the dies, are made according to the Whitworth or Franklin Institute standards when so ordered, but otherwise are of the V pattern.

These several features combine to make the screw cutter an admirable machine, and one capable of producing the highest grade of work.

Natural Gas Notes.

The Edgar gas well at Canonsburg, Washington Co., Pa., was recently struck by lightning, and for five days burned furiously. The roar of the escaping flames could be heard for a distance of eight miles. The gas burned at least 125 feet above the ground. As the well is much the largest that has ever caught fire, its extinguishment was a matter of considerable difficulty. It was thought at one time that a special machine would have to be constructed, and, in fact, such a piece of mechanism was actually ordered, but the superintendent in the mean time decided to try the expedients at hand. A track was laid up to the mouth of the well. As many of our readers, unacquainted with natural gas, will hardly understand how this could be done, it may be well to state that at such high pressures as prevail in the Washington district, the gas jet shoots straight into the air in a solid blast, and the flame is many feet distant from the actual mouth of the well. When the track had been completed, a heavy iron carriage, on which an upright smoke stack had been placed, was moved gradually toward the well. Guy ropes supported the stack during transit. When almost over the mouth, the ropes were given a sudden jerk, and the smoke stack set squarely over the escape pipe. The force of the blast kept it in vertical position. Another sudden jerk of the guy ropes, and with the overturning of the stack the flames were extinguished. When this same plan was tried without the carriage, the pressure of the gas blew the stack 20 feet. It will be remembered that a very similar plan was tried during the disastrous fire at Murraysville in the winter, except that the carriage was replaced by a temporary derrick.

The Pennsylvania Natural Gas Co. is now at work putting down one of the longest continuous lines of piping that has has ever been laid under any of the river beds near Pittsburg. It will pass under the Ohio River from Allegheny to Cork's Run. The section under the river is 3,000 feet in length and cost $5 per foot, exclusive of the pipe. A trench 6 feet deep and 12 feet wide was made by the Monongahela Dredging Co., for the reception of the 10 inch main, which will be followed later by a second one of the same size. This gives the company connection with their 12 inch gas main running directly to the Washington field. They are extending their lines through both Pittsburg and Allegheny. The vigorous competition which they propose to wage against the Philadelphia and other companies will probably effect a marked reduction in the price of natural gas.

Mitis or Wrought Iron Castings.

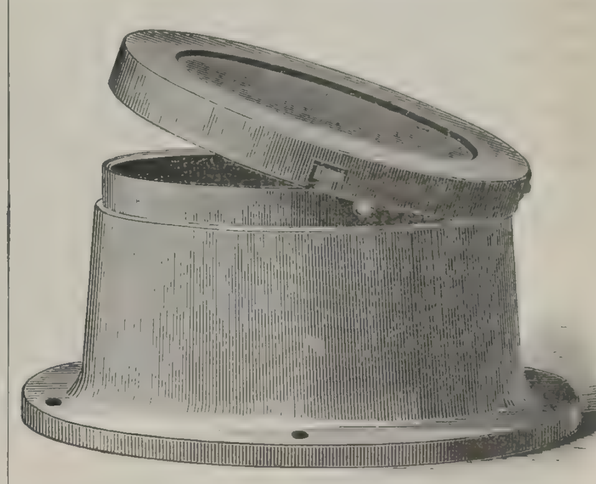
We gave articles on this subject in our paper of Feb. 6 and Feb. 20. Mr. Pedro G. Salom, at the meeting of the Franklin Institute of May 19, 1886, gave an oral account of the process of manufacturing castings of wrought iron and steel, called by the inventor, Mr. Peter Ostberg, of Stockholm, "mitis" castings, and exhibited a number of specimens of the same. Mr. Ostberg has made use of the well known fact that certain alloys of metals possess a fusing temperature much lower than that of the metals composing them; and among these, aluminum alloys are especially notable. In making "mitis" castings, a very small quantity, about 0·5 of one per cent, of aluminum, in the form of a seven or eight per cent aluminum alloy of cast iron, is added to the charge (about sixty pounds) of wrought iron in the crucible the moment this has been melted. The fusing point is at once lowered some 500°, and the charge, now an alloy of iron and aluminum, becomes extremely fluid and can be cast in the finest moulds, while the great difference between its temperature and its fusing point gives all the time necessary for manipulating it without danger of its solidifying. The extreme fluidity of the charge allows the ready escape of the gases, which otherwise would make a porous casting, and the result appears to be a remarkably fine, solid, and tough casting of wrought iron.

ANDREWS' DECK LIGHT AND VENTILATOR.

The improved form of deck light and ventilator shown in our illustration is the invention of Mr. H. N. Andrews, of Gloucester, Mass.

It is represented with the glass cover partly raised from the base, to which it is attached by a brass chain. When closed, the cover is securely held in place by reverse locks, and is perfectly water tight. When open, it serves as a light and ventilator combined. The base is usually made of galvanized iron, and is set into the deck, flush with the top of its lower flange, being secured by five screw bolts.

Two sizes are manufactured by the inventor, their diameters being 10 and 14 inches respectively, and the



ANDREWS' IMPROVED DECK LIGHT AND VENTILATOR.

height in both cases 7 inches. The cover is made of brass. In the two sizes, the panes of glass are respectively 5 and 9 inches. The device forms a neat and very desirable addition to all decked vessels where light and ventilation are needed. Its cost is quite moderate.

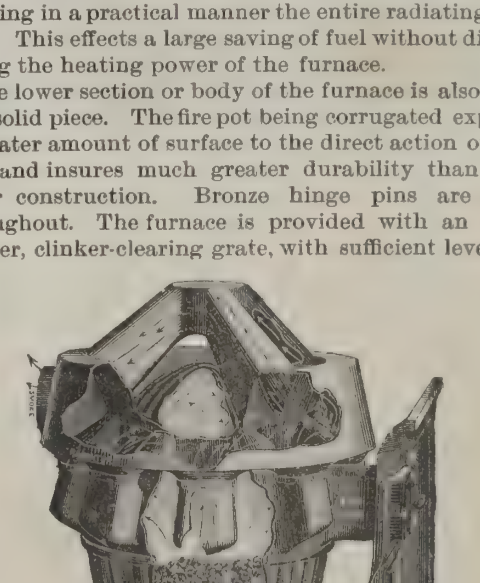
THE BOYNTON "NEW GAS TIGHT" SELF-CLEANING FURNACE.

In the "New Gas Tight" self-cleaning furnace, invented and patented by Mr. N. A. Boynton, there are a number of novel features of construction which make it worthy of attention.

The general outlines are shown in our illustration. It combines all the features of a revertible flue furnace. The radiator is cast in one solid piece, and is adjustable to any position of smoke pipe. It is so constructed that it is entirely self-clearing, thus dispensing with the trouble of cleaning, which is unavoidable in other styles of furnaces.

By the concentration of all the products of combustion in the center flue of the radiator, they must of necessity pass through all the flues of the body, thus utilizing in a practical manner the entire radiating surface. This effects a large saving of fuel without diminishing the heating power of the furnace.

The lower section or body of the furnace is also cast in a solid piece. The fire pot being corrugated exposes a greater amount of surface to the direct action of the fuel, and insures much greater durability than any other construction. Bronze hinge pins are used throughout. The furnace is provided with an anti-clinker, clinker-clearing grate, with sufficient leverage



BOYNTON'S "NEW GAS TIGHT" FURNACE.

to permit it to be operated with perfect ease with the doors closed, thus obviating all dust when shaking.

These heaters are manufactured only by the Boynton Furnace Company, of 94 Beekman Street, New York, and 75 and 77 Lake Street, Chicago.

MESSRS. WOOD, TABER & MORSE, of Eaton, N. Y., have favored us with a beautiful lithographic plate in colors, representing their four-driver traction engine, which has become widely introduced at the West.

THE ROYAL HOLLOWAY COLLEGE FOR WOMEN.

Holloway College was erected by the late Mr. Thomas Holloway. As will be seen from our illustrations, the building is a magnificent structure in the Renaissance style of architecture, of grand dimensions. The architect, Mr. W. H. Crossland, has evidently given much time to the study of the magnificent French chateaux of the sixteenth century. There is to be observed a considerable amount of originality, both as to plan and detail.

The most striking view of the new college is from the gardens, where the fine frontage line, broken in the center by a lofty tower, and flanked at either end by pavilions, presents a singularly noble appearance. This is represented in our illustration. The building is divided into two quadrangles by a range of buildings, consisting of the dining hall, kitchens, and a circular hall crowned by a kind of open work cupola, which goes by the name of the Water Tower, as it contains the great tank. The entrance gate, with its lofty clock tower and boldly vaulted passage, is another feature which will claim attention. The picture gallery, containing a superb collection of modern works of art, valued at above 90,000*l.*, is a new feature in an educational establishment, and is a singularly handsome apartment, over one hundred feet long by thirty feet wide. Ranging with this, but on the opposite side of the entrance gateway, is the sumptuous chapel, a kind of English translation of the Sistine Chapel at Rome, richly adorned with bass-reliefs and polychromic decorations.

The library and museum are similarly treated rooms, very attractive and picturesque, and situated in the garden front of the college. The quaint and sturdy-looking staircases are well studied details. While the grandeur of the principal apartments has received all care and attention, it must not be supposed that comfort and convenience have been overlooked. The studies and bed rooms provided for the girl students are just what they ought to be, and have a look of home comfort about them which will certainly be appreciated. The class rooms are also cheerful and very pleasant apartments, furnished elegantly but substantially. The architect's designs have been admirably carried out by Mr. J. Thompson, the well-known builder of Peterborough. Together with its furniture, pictures, and fittings, the building has cost about 600,000*l.*, exclusive of an endowment of 200,000*l.*; the materials are red brick and Portland stone. The college is surrounded on all sides by wide stone terraces, from which magnificent views are obtained of the surrounding country. Her Majesty the Queen opened the building on the 30th of June last. The only object for regret connected with the college is the lamented death of its generous founder, which took place on the 26th December, 1883. This event, however, has not been allowed to interfere with the completion of the scheme. Mr. Martin Holloway and Mr. Driver Holloway, brothers-in-law of the founder, have carried out the work from funds bequeathed for that purpose by the founder.

OPENING BY THE QUEEN.

The Royal Holloway College, for the higher education of women, at Mount Lee, near Egham, a description of which appeared in a recent issue of the *City Press*, was formally opened by the Queen on Wednesday afternoon, June 30. The weather was glorious, and the townspeople recognized the importance of the occasion by suspending business and decorating the thoroughfare, for more than a mile, with flags and streamers, and with numerous mottoes expressive of loyalty and good wishes for the success of Mr. Holloway's magnificent college, which, with the endowment, has cost upward of £800,000, or four millions of dollars.

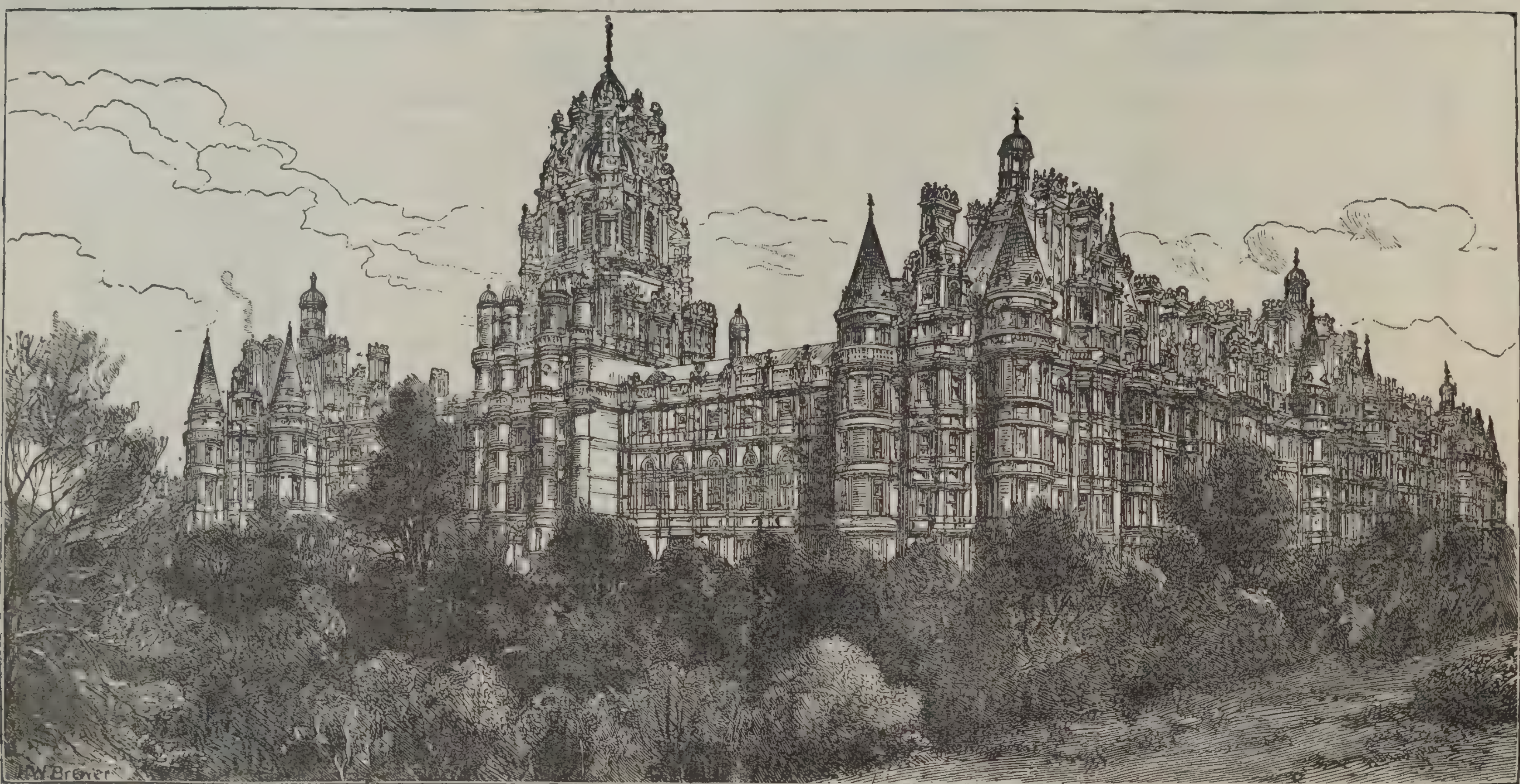
Early in the day the managers, foremen, and workmen in the employment of the contractor, Mr. John Thompson, presented Mr. Martin Holloway with an address thanking him for his liberality, and for the interest he had taken in a work extending over a period of seven years. Special trains were dispatched from Waterloo to Egham, where a large and miscellaneous assortment of vehicles were in readiness to convey some 3,000 visitors up the steep and dusty ascent to Mount Lee.

Most of the visitors found seats in the fine upper quadrangle, where the opening ceremony was to take place, a select few being permitted to take part in a short preliminary service in the chapel. The approaches were kept by a large muster of Surrey and Metropolitan police. The Grenadiers furnished a guard of honor in front of the building, on each side of the archway entrance. The bands of the Scots Greys, the Royal Artillery (under Sir George Elvey), the 2d Battalion Rifle Brigade, and the Victoria Rifles performed in different parts of the grounds at intervals during the day. The Egham Fire Brigade, numbering 24 men, were posted at the different hydrants, and lent variety to a scene already brilliant with military uniforms and the variegated dresses of the ladies.

About six hundred children from local schools were also enabled to view the ceremony. Among the early arrivals were the Duke of Connaught and the Duke of Cambridge, who, in company with the trustees and governors, awaited the arrival of the Queen at the main entrance. Her Majesty left Windsor Castle at a quarter to five o'clock in a carriage drawn by four grays, with outriders, with two Highland gillies in attendance. Her Majesty was accompanied by their Royal Highnesses Prince and Princess Henry of Battenberg, and her Grand Ducal Highness Princess Louis of Battenberg, in two carriages, and escorted by a detachment of cavalry.

The route through Frogmore, Runnymede, and Egham was lined with people, who cheered lustily as the royal carriages drove past. Her Majesty reached the college at half past five, where Mr. G. Martin Holloway was presented to her by the Duke of Connaught. Mr. Martin Holloway in turn having presented the trustees, Her Majesty proceeded in her carriage along the terraces outside the college, which gave her a good view of the magnificent exterior of the building; and having alighted at the main entrance, Miss Driver Holloway offered her Majesty a splendid bouquet. The Queen was then conducted by Mr. Martin Holloway to a special seat in the richly carved and ornate chapel near the communion table. The Duke of Connaught stood behind her Majesty, who was dressed in black, and the Duke of Cambridge, Prince and Princess Henry of Battenberg, and Princess Louis of Battenberg sat close by. An ode written for the occasion by Mr. Martin Holloway, and specially set to music by Sir George Elvey, was sung by the choir, and the Archbishop of Canterbury offered a short prayer. This concluded the service. Her Majesty, on leaving the chapel, graciously bowed to those who were seated on either side, and warmly shook by the hand Lady Wolseley and her daughter. The Queen was conducted to the picture gallery, one of the most attractive features of the college, where the architect, Mr. W. H. Crossland, was presented, and offered for her Majesty's acceptance an album containing illustrations of the college. Mr. J. Thompson (the contractor) also was presented, and in turn gave her Majesty a gold key. The Queen, having passed along the corridor, and through a vestibule under the central tower, emerged from behind the canopy in view of the vast assemblage, who cheered with great enthusiasm. Mr. Alderman Savory, who is one of the trustees, had previously conducted the Archbishop of Canterbury and the Dean of Windsor to the dais, where they awaited the arrival of royalty. As her Majesty was shown to the chair of state, a choir of vocalists, the ladies being dressed in white with pink trimmings, sang the national anthem, being accompanied by the band of the Royal Artillery. The Queen having received a parasol to protect her from the burning heat of the sun, repeatedly bowed in acknowledgment of the enthusiasm evinced by the spectators on every side.

Mr. Martin Holloway presented the following address, which was taken as read, in an elegant gold box: "May it please your Majesty: I have the honor to express to your Majesty, on behalf of the governors and trustees of this college, their deep sense of gratitude for the gracious proof of your Majesty's interest in their important and responsible work, as evinced by your august presence on this occasion. I will not intrude upon your Majesty at this moment with any lengthy description of the history and objects of this college, which was founded and planned by my relative, the late Thomas Holloway, upon the most generous and philanthropic lines, for the improvement of women's education, morally and intellectually. For many years his mind was dominated by the idea that if a higher form of education would ennoble women, the sons of such mothers would be nobler men; and to this idea, which had already passed the stage of experiment, he devoted his fortune and his energies. As a college for these women students he has given this magnificent edifice, which your Majesty has so graciously honored; and it remains for the administration, under God's blessing, to realize and develop the founder's desire, so that while the Royal Holloway College shall, by its curriculum, advance the standard of women's education, it shall ever remain an orderly Christian



HOLLOWAY ROYAL COLLEGE FOR WOMEN.—GENERAL VIEW FROM THE GARDENS.

household, where each student may, above all things, feel her individual responsibility to God."

Her Majesty's reply was as follows: "I thank you for the loyal address which you have presented to me on behalf of the governors and trustees of this college. In opening this spacious and noble building, it gives me pleasure to acknowledge the generous spirit which has been manifested in the completion, by voluntary effort, of a work promising so much public usefulness. I gladly give the assurance of my good will to the administration to which the college is about to be intrusted, and I earnestly hope that their efforts to promote the objects for which it has been founded and planned by your relative may be rewarded by a career of abiding success."

The Earl of Kimberley, who was the Minister of State in attendance, said, in a voice clearly audible throughout the quadrangle, "I am commanded by her Majesty to declare this college open." (Cheers.)

The trumpeters of the Second Dragoons played a fanfare, and the Archbishop pronounced the benediction.

Her Majesty passed smiling from the dais over a crimson cloth to the main entrance, accompanied by the other members of the royal family, and shortly afterward drove away amid loud cheering, which was taken up outside the college gates. Light refreshments were served in the quadrangle, this department being well attended to by Messrs. Ring and Brymer. Colonel Sewell, who superintended the proceedings, was conspicuous in his militia uniform.

The gold casket presented to her Majesty was executed by the Goldsmiths' Alliance (limited). The casket is of 18 carat gold, and of oblong octagon form. It rests on four pediments, on each of which is seated a female figure, which are respectively emblematical of education, science, music, and painting. These figures are very finely modeled, and each has its appropriate attributes. On the front panel is an admirable view of the Royal Holloway College, on either side of which is a medallion containing the royal and imperial monogram, V.R.I., executed in colored enamel. Underneath the view is the monogram of the founder, Mr. Thomas Holloway, also in enamel. In the corresponding panel on the reverse side of the casket is the following inscription in blue enamel: "The Royal Holloway College, founded and endowed by Thomas Holloway, opened by her Majesty the Queen, June 30, 1886." On either side of this panel the medallions containing the royal monogram are repeated. At one end of the casket the royal arms, and at the opposite end the Holloway arms and motto, "Nil Desperandum," are richly emblazoned in enamel. The casket is surmounted by a portrait model of Thomas Holloway seated in a classic chair, being a reduction from a model from life taken by the Italian artist Signor Fucigna.

The magnificent fortune now devoted to this noble institution was accumulated by the sale of a patent medicine, "Holloway's pills."

A BLOCK OF CITY DWELLINGS.—J. F. BURROWS, ARCHITECT, NEW YORK.

A BLOCK OF CITY DWELLINGS.

Our illustration shows the façade of a group of city houses designed by Mr. J. F. Burrows, architect, of 161 Broadway, New York, and proposed to be shortly erected under his supervision for Messrs. A. F. Kenny and I. White, on the Riverside Drive, New York.

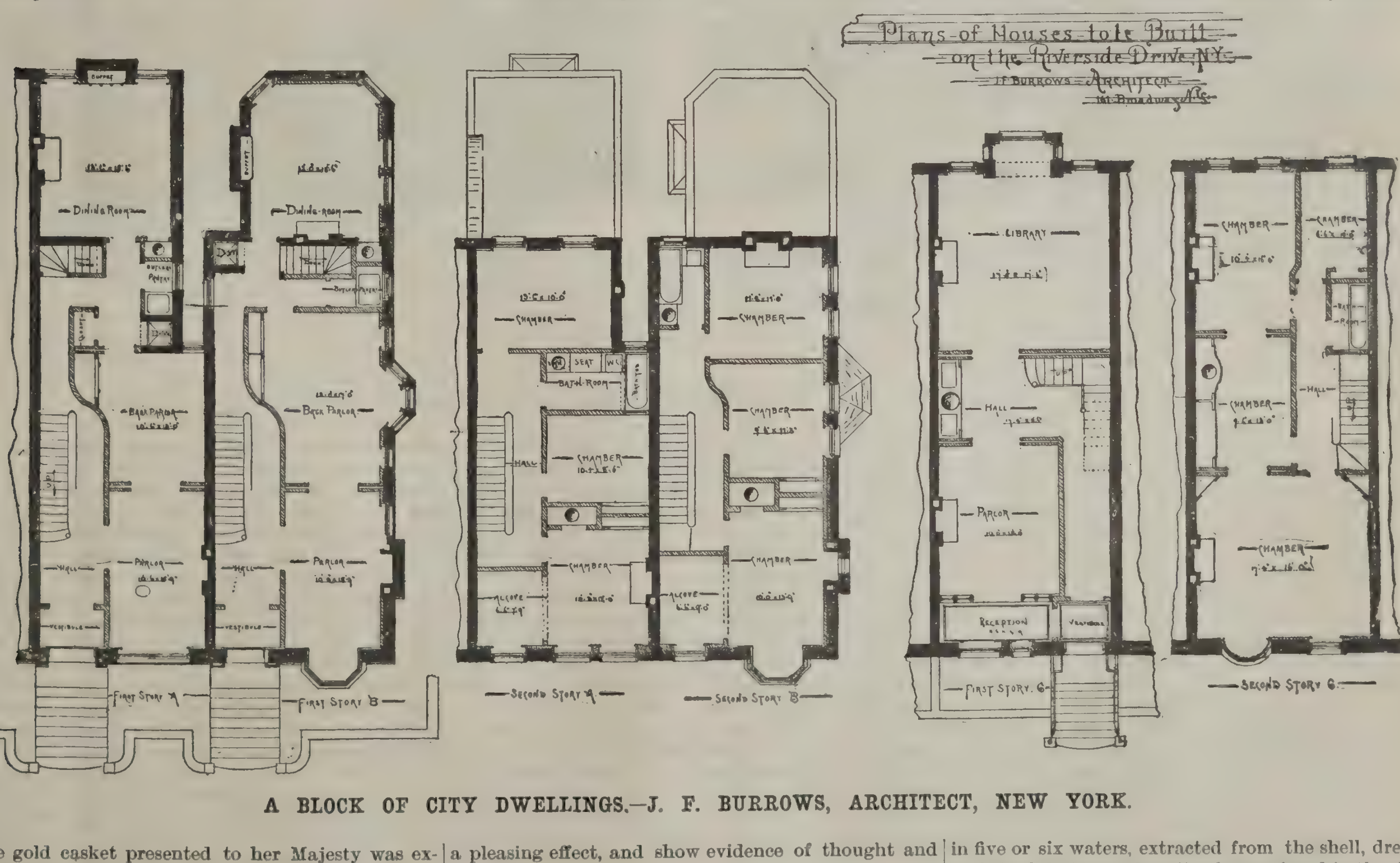
The architect's desire to realize an economical yet attractive façade has not prevented his producing a handsome and unique group of dwellings, which give a pleasing effect, and show evidence of thought and care.

The materials to be used in the front are gray marble or freestone or the basement story, porticoes, and trimmings, and selected Connecticut dull faced bricks for the walls. The hoods of bay windows to be red pantiles, and balconies terra cotta, with cornices of terra cotta and pantiles, producing a very pretty effect.

The plans show three separate arrangements, which will make very convenient houses, with many opportunities for display and decoration.

The trim throughout will be hard wood, of handsome design, and the staircases will form fine features, cherry, cedar, mahogany, and oak being used in the different houses. The dining rooms or libraries will have settees upholstered in leather, niched in the side of the rooms; and the houses will be fitted with all modern improvements, and will make a fine block when completed.

It is estimated that the cost of the houses marked A and C will be about $13,000, and those marked B about $20,000.



A BLOCK OF CITY DWELLINGS.—J. F. BURROWS, ARCHITECT, NEW YORK.

Snail Crop in France.

We learn from a contemporary that the snail harvest has just begun in France. The "poor man's oyster" is so appreciated, that Paris alone consumes about forty-nine tons daily, the best kind coming from Grenoble or Burgundy. The finest specimens are carefully reared in an *escargotiere*, or snail park, such as the poor Capuchin monks planned in by-gone days at Colmar and Weinbach, when they had no money to buy food, and so cultivated snails. But the majority are collected by the vine-dressers in the evening from the stone-heaps, where the snails have assembled to enjoy the dew. The creatures are then starved in a dark cellar for two months, and when they have closed up the aperture of their shell, are ready for cooking. According to the true Burgundy method, they are boiled in five or six waters, extracted from the shell, dressed with fresh butter and garlic, then replaced in the shell, covered with parsley and bread crumbs, and finally simmered in white wine.

A BAPTIST missionary in China writes home that what an American family throws away in a year would keep a dozen Chinese families; and what a Chinese family throws away in the same time would not feed a mouse.

DESIGN FOR A BRICK AND WOOD RESIDENCE.

The admirable design for a country residence shown in the perspective drawing and in the plans annexed is about to be erected for C. H. Crockett, Esq., at New Haven, Conn. The elevation is very happily treated, and forms a particularly attractive front of unusual merit, while the arrangement of the rooms in plan has been judiciously and carefully worked out.

The house is to be erected of bricks up to the top of the first story, and pressed bricks are to be used for the face work. The window heads, water table, and trimmings are of brownstone, and the underpinning is for the most part of red sandstone. The upper portion of the house and the piazza are mainly of wood, the roof being covered in with black slates. The cresting and finials are of galvanized iron, and add to the finish of the elevation.

The interior of the house is to be finished in an attractive and substantial manner, ash being used for the trim in the principal rooms and natural pine in the remainder.

The staircase shown upon the plans will be finished in ash, and will form a striking and important feature of the interior. It is intended to paint the woodwork on the outside of the building a dark red, to match the brick and stone work, and to pick out the trimmings, etc., with a bronze green, which will have a pretty effect.

DESIGN FOR A RESIDENCE, NEW HAVEN, CONN.—C. H STILSON, ARCHITECT.

The cost of the structure, it is calculated, will be about $6,000. Mr. C. H. Stilson, the well-known and prominent architect of New Haven, Conn., is the author of the design, and will superintend the erection of the building.

The floor plans for this dwelling will be given in our next number.

An Architectural Adjunct.

Ambitious, as well as critical, artists are aiming at and hoping for an "American architecture," a system or method peculiar to this continent. There are certain elements in every structure of merit which, while they are termed adjuncts, are still essential to any satisfactory realization of artistic taste. One of these essential adjuncts is stained glass work. It is not so well known as it ought to be that right alongside of the progressive architects of this country there are a few at least of genuine artists and skillful constructors in the domain of stained glass ornamentation, who are striving to emulate, if not surpass, the celebrated artists and manufacturers of Europe. A brilliant writer on American architecture, in a recent magazine article, says: "What we need is some scheme or schemes able to meet all demands, however lofty, however modest; possible of modification into new expressions, and capable of receiving new decorative motives." It is in the line of realizing this conception or aim, precisely, that the now deservedly celebrated artists and manufacturers, Redding, Baird & Co., of Boston, are laboring and achieving such brilliant successes. They appreciate the fact that the stained glass ornamentation of edifices is truly "capable of modification into new expressions;" and this firm has notably succeeded in "meeting all demands, however lofty, however modest." Allied in spirit and effort with the best architects in America, Redding, Baird & Co. are working out the problem of stained glass conveniences and decoration in a manner sure to place them in advance of their best rivals.

Fall of a Warehouse.

On Sunday evening, the 18th July, the front wall of a warehouse situated in Roosevelt Street, at the rear of No. 176 South Street, New York, fell out, burying three people in the ruins and imperiling the lives of a large number of others, living in this crowded neighborhood.

The building of which the wall formed part was built some 50 years since and was five stories in height. It was in the occupation of Messrs. Noah T. Swezey, Son & Co., who used it for storing flour, it being calculated that there was a weight of some 600 tons upon the building at the time of the accident.

The event is interesting, as showing in a very clear manner the effect of inferior mortar and the bad construction of brickwork. An examination of the scene of the accident before the debris had been moved showed that the floor joists were large and presumably of ample dimensions to bear the weight put upon them, and no signs of decay in them could be seen. The bricks were quite sound and of good quality, in fact, even better than one would expect to find in a building of this class 50 years old.

What, however, was conspicuous, was the manner in which the bricks had separated, there being scarcely two adhering, and the whole presented an appearance almost as though they had been dumped from a cart. Even in portions of the brickwork which had fallen upon the piled barrels, and had not reached the ground, the bricks were separated from one another. The greater part of the mortar was in a state of powder, and small pieces strewn around could be easily crumbled between the fingers.

The barrels of flour were packed on their sides, seemingly without care or judgment, as many being got into the building as it would hold. Probably the lower ones were not quite close together, and if this were so, the pressure of the barrels above would act as wedges between those below, tending to separate them and causing a considerable outward thrust on the walls. Even in close packing there would be not a little outward thrust unless the barrels were arranged in the form of a pyramid, which in this case they were not.

In construction it is always unadvisable to put any direct thrust upon a wall; the whole of the weight should be arranged where possible as a dead load, and the reason of this will be apparent when it is considered that while brickwork will bear from 600 to 2,000 pounds per square inch as direct crushing weight, it only requires from 12 to 24 pounds per square inch to separate the bricks by a shearing strain. Remembering these facts, it can be seen how important it is, in packing such articles as barrels, to arrange them quite close together to form a pyramid, so that they exert no thrust whatever upon the wall.

In this case the strength of the mortar was probably a good deal below 12 pounds per inch. A staircase or well hole running close to the wall centered up the weight to some extent. The wall was of the usual construction, with a 4 inch facing on the outside, built, as is unfortunately usual, with little or no bonding to the back of the wall. It is easy to understand, considering these circumstances, how the failure occurred. The pressure of the barrels arranged in so stupid a manner exerted a thrust on the badly constructed wall, this thrust, comparatively small as it was, being sufficient to push the wall out. Had the mortar been of better quality, it is probable that the wall would not have fallen.

Railroads of the World.

The aggregate length of railroads of the world in 1884, as shown by official statistics, was 290,750 miles, of which no less than 62,788 miles have been opened since 1879. At the close of 1884, Europe had 117,694 miles; America, 148,738; Asia, 12,757; Australia, 7,486; and Africa, 4,075. In 1880, America had but very few more miles of railroad than Europe; four years later, however, it had 31,044 miles more than Europe, and of the total increase of 62,788 miles in that four years, more than two-thirds was in this country. The vast territory of Asia has only about as many miles of railroad as the single State of Illinois, and seven-eighths of this is in the English dependency, India. In Europe nearly one-fourth of the railroads built since 1880 were in France, which has increased its mileage 3,121 miles, or 19·2 per cent, in the four years.

In America there were but 15,185 miles of railroad outside of the United States at the end of 1880, and this had increased, by the end of 1884, 8,252 miles, or 54½ per cent, to 23,437 miles. Mexico gained most, but Canada was close behind. Elsewhere in America the new construction amounted to but 3,320 miles, of which 1,818 miles were in Brazil and 1,106 miles in the Argentine Republic. In South America altogether there were but 9,515 miles of railroad at the end of 1884, 3,071 miles of which had been opened since 1880, an increase of nearly 50 per cent. Calculation shows that of the 290,750 miles of railroad in the world, no less than 174,016, or 60 per cent, are in English speaking countries.—*The Stockholder.*

Paper Pipes.

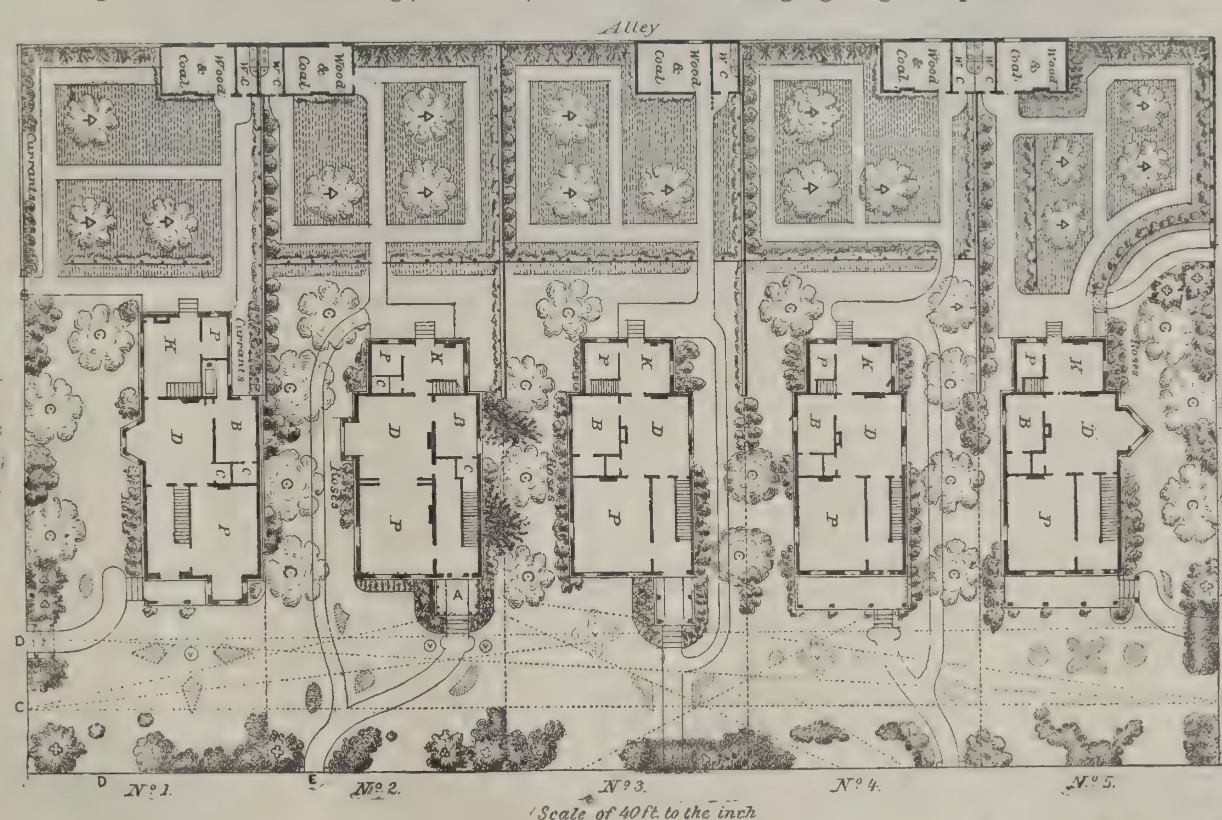
In Vienna there were recently exhibited gas and water service pipes made of paper. The same kind of pipes will do for many factory purposes, and for laying electrical wires, etc., we should suppose it to be specially useful. The pipes, according to the *Paper World*, are made as follows: Strips of paper are taken, the width of which corresponds with the length of one pipe section. The paper is drawn through melted asphalt, and wound upon a mandrel which determines the inner diameter of the pipe. When the pipe thus made has cooled, it is pulled off the mandrel and the inside is covered with a kind of enamel, whose nature is kept secret by the makers. The outside is painted with asphalt varnish, and dusted over with sand. It is stated that such a pipe will resist some 2,000 pounds internal pressure, though the thickness of the stuff is only about half an inch.

ADJOINING GROUNDS AND DWELLINGS.

By a little concert of action among the owners of contiguous grounds and dwellings, much may be done to add to the beauty and attractiveness of the street, and thereby to raise the value of each property.

In general, it is desirable to discard the separating fences, and thus throw the front portions of the several lots into one lawn, which, properly planted, will have a beautiful effect, at the same time allow to each dwelling a proper prospect in all frontal directions.

We give a plan for such an arrangement for the front lots of five adjacent dwellings. It will be noticed that shrubbery is arranged near the sidewalk line; but between this outer line and shrubbery and the fronts of the dwellings, no shrubbery is placed, thus leaving a long, elegant, unobstructed lawn. This is an essential feature of the plan, and should always be carried out when possible. Ornamental flower beds may be introduced on the lawn; suitable trees may be planted between the buildings. Gardens and other conveniences may be arranged in the rear, as shown in our illustration.



PLAN FOR LAWN IN FRONT OF CONTIGUOUS BUILDINGS.

The editor wil be glad to receive hints and suggestions from readers respecting the laying out and adornment of grounds.

Fire Dangers from Steam Pipes and Hot Air Flues.

In the course of a recent lecture by Dr. Tanner before the Louisville Board of Underwriters, the subject of fires caused by steam pipes and hot air flues was discussed at considerable length. In the course of his address, Dr. Tanner spoke as follows:

Mr. James Braidwood, who was for many years chief of the London Fire Brigade, made the startling statement in 1846 that it was his belief that "by long exposure to heat not exceeding 212 deg. timber is brought into such a condition that it will fire without the application of light. The time during which this process will go on until it ends in spontaneous combustion is from eight to ten years, so that a fire might be hatching in a man's premises during the whole time of his lease without making any sign." Among the many instances cited by Mr. Braidwood in support of this statement is one to the effect that a fire in the Bank of England was traced to a stove which was resting on a cast iron plate one inch thick, this in turn resting on concrete two and a half inches thick, which was supported by wooden joists, the joists under the stove igniting. If this is a cause of fire, then the majority of houses heated by means of steam, hot water, and hot air are in constant danger of the fire from spontaneous combustion, since the general impression prevails that the pipes and flues for heating can with impunity be placed in contact with timber.

In examining this cause of fires, the first question is whether wood will char at as low a temperature as 212 deg. In tearing down houses for the purpose of rebuilding, the timber in contact with the heating pipes and flues has often been found charred. Charcoal is made for certain purposes in the arts at 300 deg. As he result of experiments performed by myself, in the laboratory, small pieces of white pine heated a few hours in an air bath at a temperature of 300 deg. were partially converted into charcoal. Considering these facts, it must be admitted the temperature of 212 deg. is sufficient, if applied for a long time, to convert wood into a partially burned charcoal. Accepting this as a fact, the next point to consider is the degree of heat at which charcoal will ignite. Made from the same wood at different temperatures, the products ignite accordingly; that is, if made at a low heat, it fires from a correspondingly low temperature. It has been determined experimentally that charcoal for making powder, when made at 500 deg., would fire spontaneously at 680 deg.; and when wood has been carbonized at 260 deg., a temperature of 340 deg. only was required for spontaneous ignition. Under certain circumstances, charcoal made at a temperature of 500 deg. even will ignite when heated to 212 deg.

So far the discussion of heating pipes and flues as a cause of spontaneous fires has been upon the false idea that they are never heated beyond 212 deg. Under the ordinary pressure of the atmosphere, as when water is heated in the open air, it boils at 212 deg., but if it is heated under pressure, the boiling temperature increases accordingly; for instance, water boiling at a temperature of 212 deg. is under a pressure of 147 pounds, equal to a column of water one inch square and about thirty feet high; if the pressure is increased to two atmospheres, the temperature required will increase to 249 deg., and so on, so that when a steam gauge registers 60 the actual pressure is 75 pounds, and the temperature at which the water is boiling as high as 307 deg. The higher the house, the greater must be the pressure, and hence the higher the temperature at which the water boils, and it follows that the pipes must heat hot accordingly, and it is stated that in some systems of water heating the pipes have the water started through them at a temperature of 350 deg.*

Then, where furnaces are used for heating, the temperature in a flue has been found to be 300 deg., at a distance of fifty feet from the fire. Couple these figures with those given in reference to the heat necessary to produce charcoal and cause its ignition, and it must be admitted that these pipes and flues for heating are responsible for many fires. The application of these facts is as follows: After long exposure, the wood in contact with the heating pipes and flues is changed on the surface to charcoal. During the warm season this charred surface absorbs moisture from the air; then in the fall comes a cold spell and heat is turned on, when the moisture is driven from the pores of the charcoal, leaving it in a condition to readily absorb gases. The cold abates and the heat is lowered; fresh air in abundance then passes into the confined spaces where the pipes are generally placed, rapid absorption of oxygen from the air by the charcoal follows, with heating and spontaneous firing as already explained.

The body of the timber is heated, and this heat prevents too rapid cooling of the charred surface when the fresh air passes in, otherwise the charcoal would be placed under circumstances unfavorable to ignition. The experiment of burning iron filings in the flame of a spirit lamp illustrates the influence of division upon the igniting point; now, if the iron is in a pulverulent state, as when made by hydrogen, it will, when freshly made, ignite to a red heat when shaken into the air. Then, if it is true, as stated by an English scientist, that the oxide of iron, if placed in contact with timber and excluded from the air, and aided by a slightly increased temperature, will part with its oxygen and be converted into very finely divided particles of metallic iron, here is another cause of fires from heating pipes. For during the summer the pipes rust, and then when heated the rust is reduced, leaving the metallic iron in the same condition as that made by hydrogen; the temperature is lowered, fresh air appears, and oxygen is rapidly taken up by the finely divided iron, each particle heating so rapidly as to give a red heat to the mass.

I have not been able to prove this experimentally, but as carbon is able to overcome quite strong chemical affinities, and will reduce the oxide under strong heat, theoretically it is possible, and the authorities all tend to prove it. Considering all the points bearing upon hot water and steam pipes, also heating flues, an explanation is found of the great number of fires occurring at the approach of winter, and which are reported as from defective flues, supposed incendiary origin, or causes unknown. Steam pipes packed in sawdust or shavings to retain the heat while steam is conveyed to a distance have given fires. One peculiar and important instance is on record of a fire from steam pipes. In the drying room of a woolen mill, a pine board was placed some three or four inches above the steam pipes to prevent wool from falling upon them. A fire followed, and after being put out, a careful examination determined to the satisfaction of all that the heat of the pipes had distilled the pitch from several knots in the pine board, and this dropping on the pipes had ignited and caused the fire. The illustration needs no comment, as the lesson is too plain to need pointing out.

* By the system of low pressure steam heating, which is far the most generally used, the pressure is only from 5 to 7 pounds above that of the atmosphere, with a corresponding temperature of 228 deg. to 235 deg. F.

Upholstering a Cow Stall.

A neighbor who uses an old horse barn for keeping his one cow found that when the thermometer indicated from 10 to 20 degrees below zero, his cow stood shivering in her stall, even with an abundance of good food to eat and warm water to drink, and that the quantity of milk given was also reduced below the usual flow. Being ingenious as well as merciful, he went to work, with such material as he could find at hand, to make his animal more comfortable. The stalls were ten feet high, the stable large, and the outside boarding somewhat loose. In other words, the ventilation was abundantly provided for. To recover the entire building was out of the question, and even were the outside fairly tight, so large a barn with only a single animal in it would still be excessively cold with such a temperature outside. The better way seemed to be to make a small room for the cow, in which her own animal heat would be better retained.

Accordingly, a single horse stall was floored over with loose boards above the cow, giving just room for the attendant to stand. This floor was then covered with old hay and straw to the scaffold floor above. The sides of the stall were made tight by battens and stuffing, and the front closed up with a door that could be opened for putting in the food at feeding time. At the rear, the supply of boards having been exhausted, old carpets, sacking, etc., were hung in several thicknesses across the stall from side to side, being tacked securely to the staging above. The cow was thus shut into a room but a little more than large enough to contain her with comfort, and comfortable it was compared to the large open space she had previously occupied. Much might be done in this, or other ways, to render farm stock more comfortable and more profitable to keep during these excessively cold spells. If stables are tight, and not too large in proportion to the number of animals, their own bodies will warm the air sufficiently for comfort. There is little occasion to worry about ventilation when the temperature gets below zero. The danger, in nine cases out of ten. is in having too much rather than too little.—*N. E. Farmer.*

THE HALL TYPE WRITER.

The first record of a type writing device was in 1714. In that year there was issued from the British Patent Office a document referring to "An Artificial Machine or Method for the Impressing or Transcribing of Letters Singly or Progressively one after another as in Writing, whereby all Writings whatsoever may be Engrossed in Paper or Parchment so Neat and Exact as not to be distinguished from Print."

Henry Mill was the inventor. No record of another attempt appears till 1841. In 1859, Mr. Thomas Hall, of New York, invented a machine, which was completed in 1866, and sent to the Paris Exhibition in 1867. In 1881, the same inventor patented the writer now manufactured by the Hall Type Writer Company, of Salem, Mass. The present Hall type writer is a wonderful little machine. It is claimed that it has the greatest capacity of any machine in the market. It has no inked ribbon, as have the various keyed machines, but prints directly from the face of rubber type, thus avoiding the chance of blurred work. The type forms are interchangeable. Fifteen styles of English are made; also type in Greek, French, German, Spanish, Portuguese, Italian, Dutch, Norwegian, Russian, Swedish, etc.

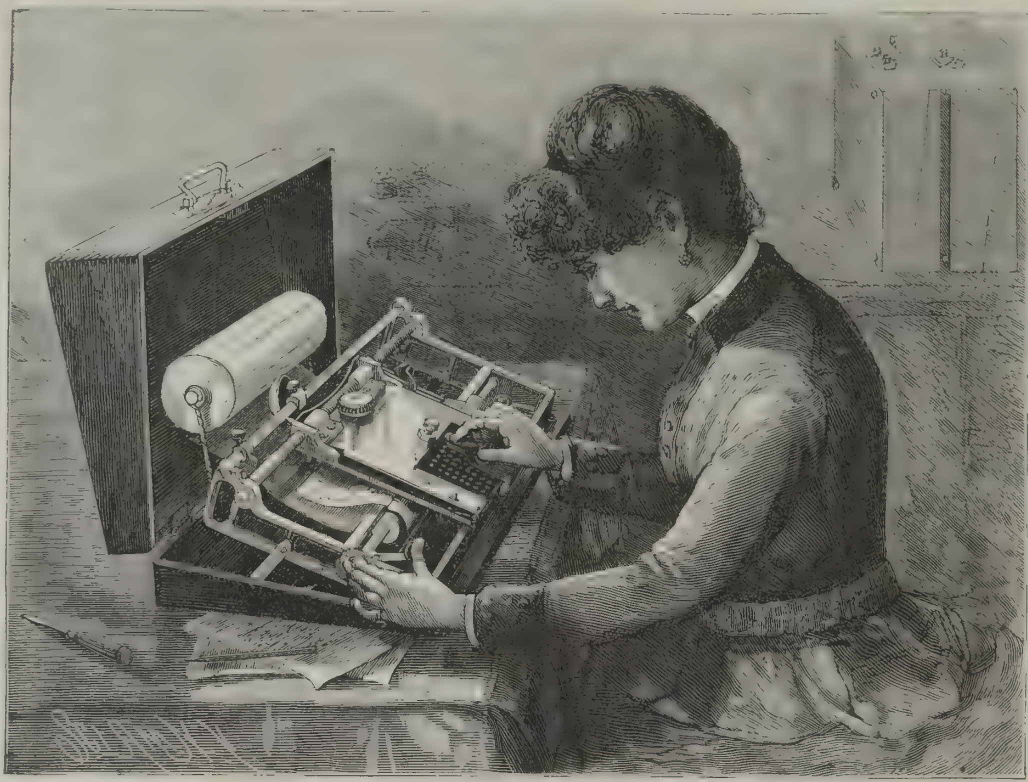


Fig. 1.—THE TYPE WRITER IN USE

The portability of the "Hall" writer is a prominent feature. Its weight is only seven pounds, and it is inclosed in a handsome box, usually of black walnut, but the case may be of any sort of wood, or covered with plush or leather. A handle is attached, for readiness in carrying. It seems incredible that such a little machine should work such wonders, but "the proof of the pudding is in the eating."

The Hall manufactory is at 194 to 200 Derby Street, Salem, Mass., and it is a well stocked and well organized factory. Various special machines and tools are required for the work, four of which are shown in our illustrations. All the parts of the machine are made with extreme care, and each part is nicely adjusted and fitted.

All the working parts of the machine are contained in a frame formed of end pieces and longitudinal bars, the frame being pivoted in the box containing the instrument, so that it may be elevated to any desired angle. The upper bar of the frame is a graduated scale carrying the stop for limiting the return motion of the carriage, and the bell for indicating when the end of the line is reached. The second bar is cylindrical in form, and is provided with series of circumferential equidistant grooves, which bear a fixed relation to the spacing of the lines.

The carriage which sustains and guides the principal working parts of the machine is formed of two parts mounted pivotally on the circumferentially grooved bar, the lower part carrying the inking pad and the feeding mechanism, the upper part carrying the feeding spring and the ingenious parallel movement which characterizes this machine.

The inking pad is mounted upon a plate having an aperture opposite the point of printing, and the upper part of the carriage is provided with an impression screw directly opposite the aperture in the lower part. Between the upper and lower part of the carriage is arranged a system of arms by which a perfectly parallel motion in two directions is secured, and upon the mechanism of the parallel motion is secured the rubber type plate, which is furnished with the letters and characters to be impressed upon the paper.

An arm extends from the support of the type plate outward, in front of the machine, between the upper and lower portions of the carriage. To this arm is pivoted a single key carrying a conical pin or pointer, which may be inserted in any one of a series of cavities in the index plate. In the bottom of each cavity there is a letter or character corresponding to one of the letters or characters on the type plate carried by the parallel movement; and the index plate, parallel movement, pointer, and impression screw are arranged relatively to each other so that when the pointer is inserted in one of the cavities of the index plate, the letter or character represented by that cavity will be brought under the impression screw, when the downward movement of the key will press the carriage downward, bringing the impression screw into contact with the back of the type plate, and pressing the particular letter of which an impression is required downward into contact with the paper lying over the third bar of the main frame.

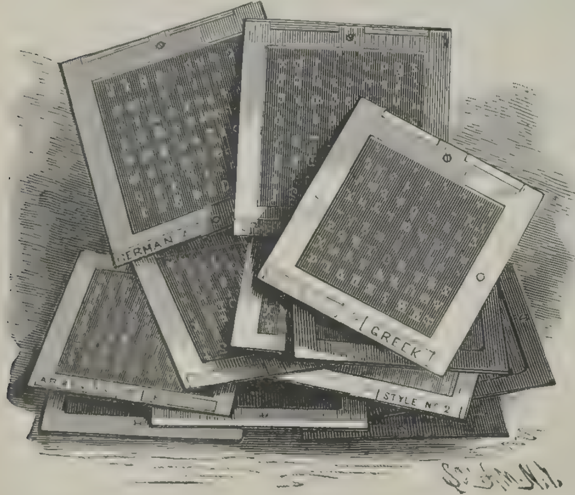


Fig. 3.

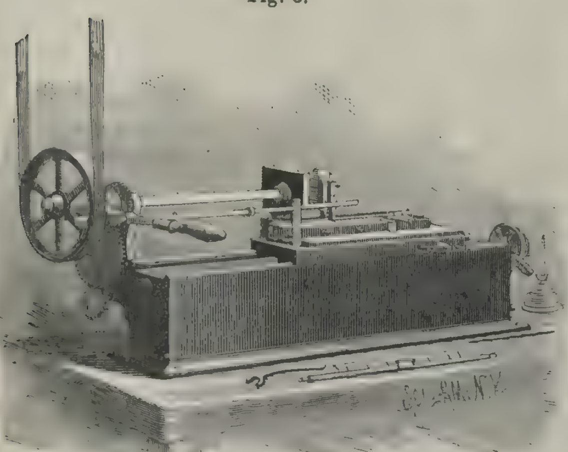


Fig. 4.

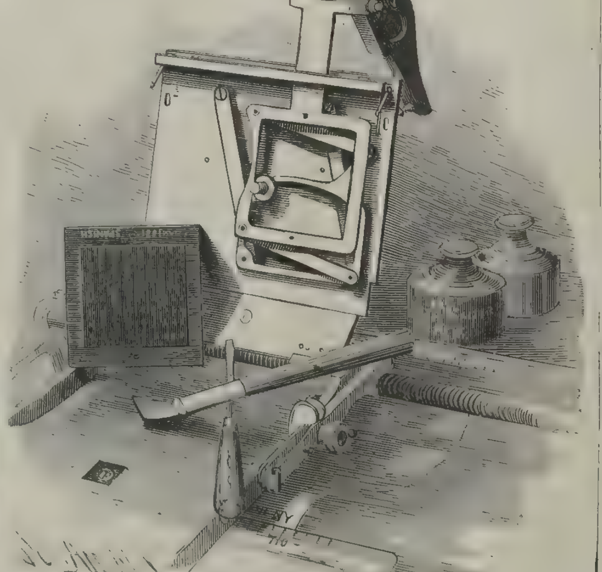


Fig. 2.

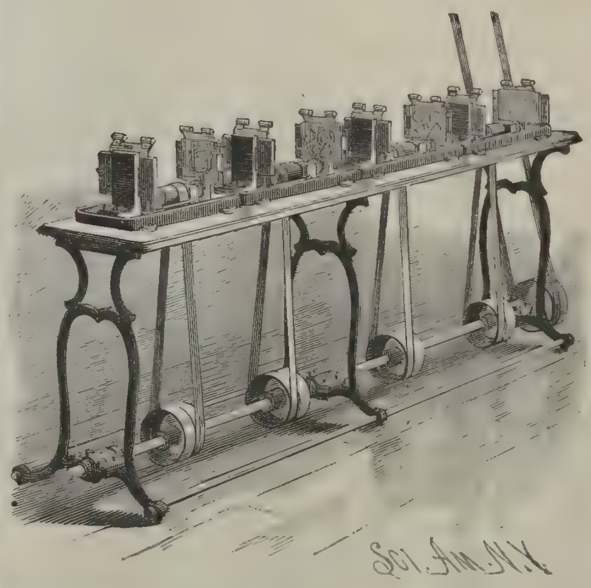


Fig. 5.

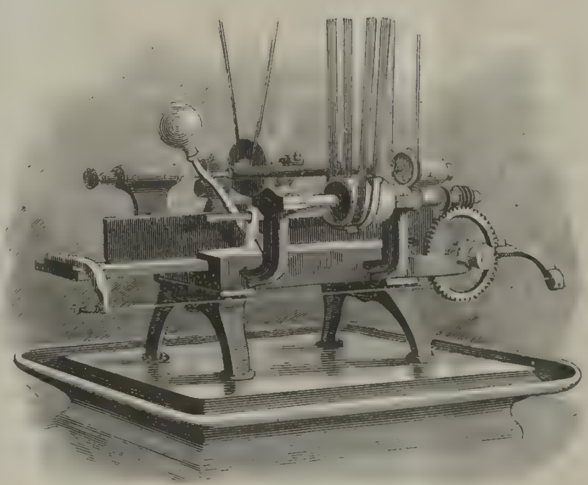


Fig. 6.

The power for feeding the carriage forward is supplied by a spring contained by the drum mounted on the top of the carriage, and provided around its periphery with teeth engaging the circumferential grooves of the bar upon which the carriage is mounted. The spring is wound whenever the carriage is returned to the point of starting, and the forward step by step movement of the carriage is effected by an escapement, mounted on the right-hand side of the carriage and working into the circumferential grooves of the bar. The escapement is arranged so as to permit the carriage to move forward a distance equal to one or two divisions of the bar, as the character of the work may require, the change in the spacing being effected by a small cam at the side of the carriage.

The escapement key is mounted on the lower half of the carriage, in position to be engaged by the upper half of the carriage, when the latter is pushed downward in the act of printing; and to the forward extremity of the key is pivoted a finger piece, which may be depressed so as to operate the escapement independently of the printing mechanism. Upon the spacing key is mounted a latch, which may be moved independently of the key when it is desired to shift the carriage quickly in either direction. When the spacing key is depressed, it engages one of the grooves of the rounded bar, and at the same time lifts the latch out of engagement with the groove in the upper side of the bar, when the latch springs laterally one or two spaces, according to the adjustment of the spacing key; and before the key is released from the groove in the bar, the latch enters a groove in the top of the bar, so that, when the key is entirely withdrawn from the groove of the bar, the carriage will be liberated and moved forward until its motion is arrested by engagement with the latch.

Under the longitudinal bar of the main frame, upon which the printing is done, is located a paper-feeding roll, which is partly incased by a semi-cylindrical metallic casing which shuts over the paper and over the beveled edge of the printing bar, and holds it accurately in position for printing, and also presses the paper into close contact with the rubber paper roll, so that, whenever the roll is turned, the paper will be moved forward for a new line. The shaft of the paper roll is provided with a milled head at one end, by means of which it may be turned to move the paper forward or backward as may be desired. In the inner face of the milled head are formed radial notches,

which are engaged by a rounded spring fastened to the end of the frame. The spring and notches serve as a stop for spacing the lines. The roller shaft is also provided with a key, by which it may be turned forward the amount required to feed the paper for a new line.

The type plates are changed by loosening and tightening two small screws, and the inking pad may be lifted out and replaced by one of another color, after unlatching the upper portion of the carriage and lifting it from the lower portion.

Fig. 7.—VULCANIZING TYPE PLATES AND RUBBER ROLLS.

Fig. 1 represents the type writer in use; Fig. 2, the carriage opened, showing the "motion"; Fig. 3, a group of type plates; Fig. 4, a graduating machine for the bell rods and "clips"; Fig. 5, a device for easing the "motions," that they may run smoothly; Fig. 6, a machine for grinding the rubber rollers; Fig. 7 illustrates the process of vulcanizing type plates and rubber rolls. The Hall type writer was awarded the medal of superiority at the semi-centennial fair of the American Institute, in New York, and the John Scott Medal by the Franklin Institute, of Philadelphia, an honor conferred on no other writer.

The Hall type writer has many points peculiar to itself which cannot be claimed by other writers, at the same time doing all the varieties of perfect work that are done by any writer. The Hall type writer is exceedingly simple, having only a fraction of the parts possessed by the keyed machines. It is perfectly portable, being of convenient size, and weighing only 7 pounds.

Each type plate has seventy-three characters. Fifteen styles of type are made for writing English, and many for other languages. The printing, being direct from the face of the type, is legible like ordinary printing. The machine takes paper of various widths and thicknesses, and will write on postal cards or envelopes. It will print with single or double spaces as required. It allows of the making of corrections with great ease.

The most intricate blanks may be readily filled in; letterpress copies from the writing are perfect; hektograph copies may be taken by using a special ink; manifold copies are secured by the use of "manifold" type forms—six good copies being readily obtained.

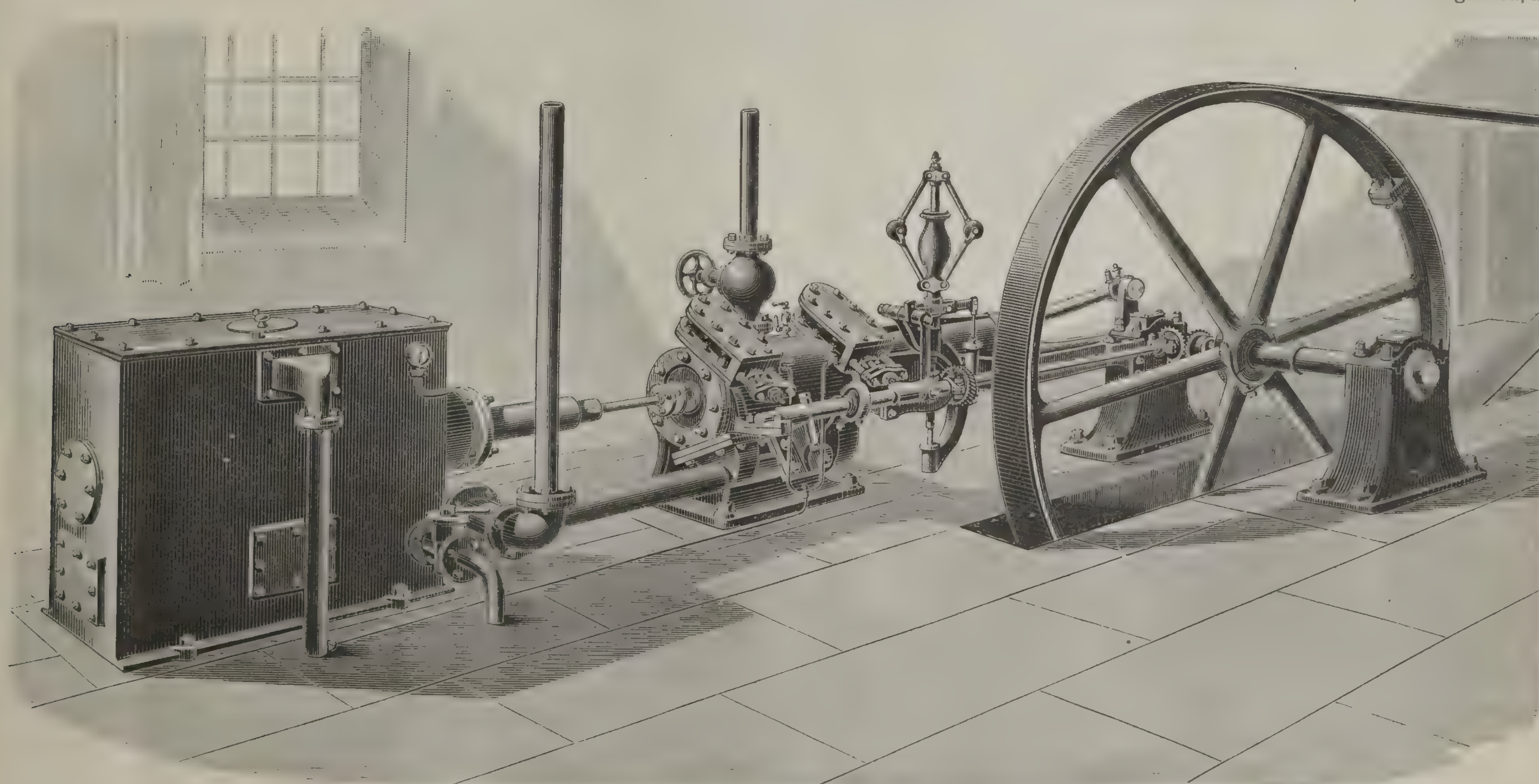
Catalogues may be had and all special information obtained by addressing the office of the company, 200 Derby Street, Salem, Mass., U. S. A.

MENNIG'S STEAM ENGINE.

Among the steam engines that figured at the Anvers Exhibition was that of the Mennig Brothers, of Cureghem. This engine, which we figure herewith, has four plane slide valves (two escapement and two admission ones), that move in planes parallel with the axis of the cylinder. The axes of the rods of the admission valves are at right angles with the axis of the cylinder. These valves are actuated by a shaft which is parallel with the axis of the cylinder, and which is driven by the main shaft through the intermedium of a pair of bevel gears. The distributing shaft carries the motive cams of the four slide valves and the helicoidal gearing that revolves the governor. The two cams of the admission valves consist of oblong sockets which slide along a square portion of the distributing shaft, and are connected with each other by a bent lever moved by the governor, which thus regulates their position, and, consequently, the duration of the admission. As soon as the cams permit it, the admission is closed by springs that act upon the valve rods outside of the distributing boxes. The escapement valves have rods that are parallel with the axis of the cylinder, and are actuated by an undulating disk fixed upon the distributing shaft. This disk communicates a backward and forward motion to a lever that acts upon the valve rods.

The governor is of the Porter style, and is provided with a cataract.

The builders have taken care to construct the sockets and valve rods in such a way that the wear to which these parts are exposed may be easily taken up.—*Chronique Industrielle.*



MENNIG'S STEAM ENGINE.

Transparent Soap.—According to Wright, many of the finer grades of transparent soap sold in England do not contain glycerine, as advertised, but sugar. Sugar seems just as well adapted to making transparent soaps as glycerine. As sugar is admitted into England free of duty, and is hence very cheap, this application of it becomes possible.—*Soc. Chem. Ind.*

Great Aggregates from Doubling Small Amounts.

The delusive result or multiplying by two, or doubling numbers several times, is very well illustrated in the following story, which a Western newspaper man has set going the rounds:

A merchant employed a clerk, who wanted the place principally to learn the business, "salary being no object." At the suggestion of this industrious seeker after knowledge and contemner of worldly goods, the merchant willingly consented to fix the salary at 1 cent for the first month, 2 cents for the second month, 4 cents for the third, 8 cents for the fourth, and so on for three years. Here is the "account," as figured out by the bookkeeper, which we may well believe "staggered" the merchant: First month .01, second month .02, third .04, fourth .08, fifth .16, sixth .32, seventh .64, eighth $1.28, ninth $2.56, tenth $5.12, eleventh $10.24, twelfth $20.48, thirteenth $40.96, fourteenth $81.92, fifteenth $163.84, sixteenth $327.68, seventeenth $655.36, eighteenth $1,310.72, nineteenth $2,621.44, twentieth $5,242.88, twenty-first $10,485.76, twenty-second $20,971.52, twenty-third $41,943.04, twenty-fourth $83,886.08, twenty-fifth $167,772.16, twenty-sixth $335,544.32, twenty-seventh $671,088.64, twenty-eighth $1,342,177.28, twenty-ninth $2,684,354.56, thirtieth $5,368,709.12, thirty-first $10,737,418.24, thirty-second $21,474,836.48, thirty-third $42,949,672.96, thirty-fourth $85,899,345.92, thirty fifth $171,798,691.84, thirty-sixth $343,597,383.68; total salary for three years, $687,194,767.35.

This is, we suppose, a modern companion of the old story where a Hungarian King bankrupted himself by paying (?) a blacksmith for putting in 32 nails in the shoes of a horse at the rate of a penny for the first nail, two for the second, etc., and suggests also the computation which shows that a grain of barley to the first square of a chessboard, two grains to the second square, and so on through the 64 squares, will give a final aggregate exceeding the whole barley crop of the world through an indefinite period. Such facts, however, always strike one with wonder the first time they are brought before the mind.

South Polar Inspection.

Since Wilkes and others found the Antarctic coast line "impenetrable," the U. S. Government should send a vessel provided with a suitable captive balloon outfit, so that if the 1,500 miles or more of inaccessible cliff 3,000 feet high cannot be passed over, it may, at least, be peeped over. From attainable altitudes, aided by telescope and camera views, to be magnified, much that is interesting may be learned. And such a balloon can be easily manipulated so as to safely land passengers and supplies on these cliffs, secure communication, and bring them away when done.

W. L. Davis.

Parabolic Matrices for Specula.

Where speculum mirrors for reflecting telescopes are to be deposited by electrolysis, a very ingenious method of preparing the matrices or moulds by centrifugal action is employed. It has long been known, and can be proved by pure mathematics, that if a vessel partly filled with a fluid be rotated, the fluid will rise up around the sides of the vessel, producing a hollow upper surface, and the outline or section of the hollow thus produced will be a parabola. The exhibition of this phenomenon on the "whirling table" is one of the regular experiments in lecture courses on physics. To form a matrix on this principle, a vessel properly mounted is partly filled with a mixture of plaster of Paris and water, or with a fusible alloy melted, and is rotated. The liquid plaster or metal, obeying the laws of centrifugal force, rises up around the sides of the vessel, which is kept rotating so as to maintain the material in a constant shape, and it gradually solidifies. The result is the production of a mathematically perfect paraboloid, ready for the reception of a coating. This forms an interesting supplement to our article on Industrial Electricity, published some weeks ago, and was brought to our attention by an exchange. The process was originated by Prof. Mendelejeff, of Russia.

Imitating Leather Surfaces.

According to the *Manufacturer and Builder*, by means of electricity the most attractive leather surfaces are now completely imitated. The leather which it is desired to imitate is first well cleaned and coated with graphite, as in electroplating a smaller article. It is then placed in a copper bath, the tank of which is large enough to easily receive a skin of any size. A dynamo electric machine generating a powerful current furnishes the current. The copper is deposited upon the coated surface of the hide to a thickness of one-sixteenth to one-eighth of an inch. The plate thus formed reproduces, but reversed, every mark and minute vein of the leather, so that a print taken from it is an exact copy of the original in every detail.

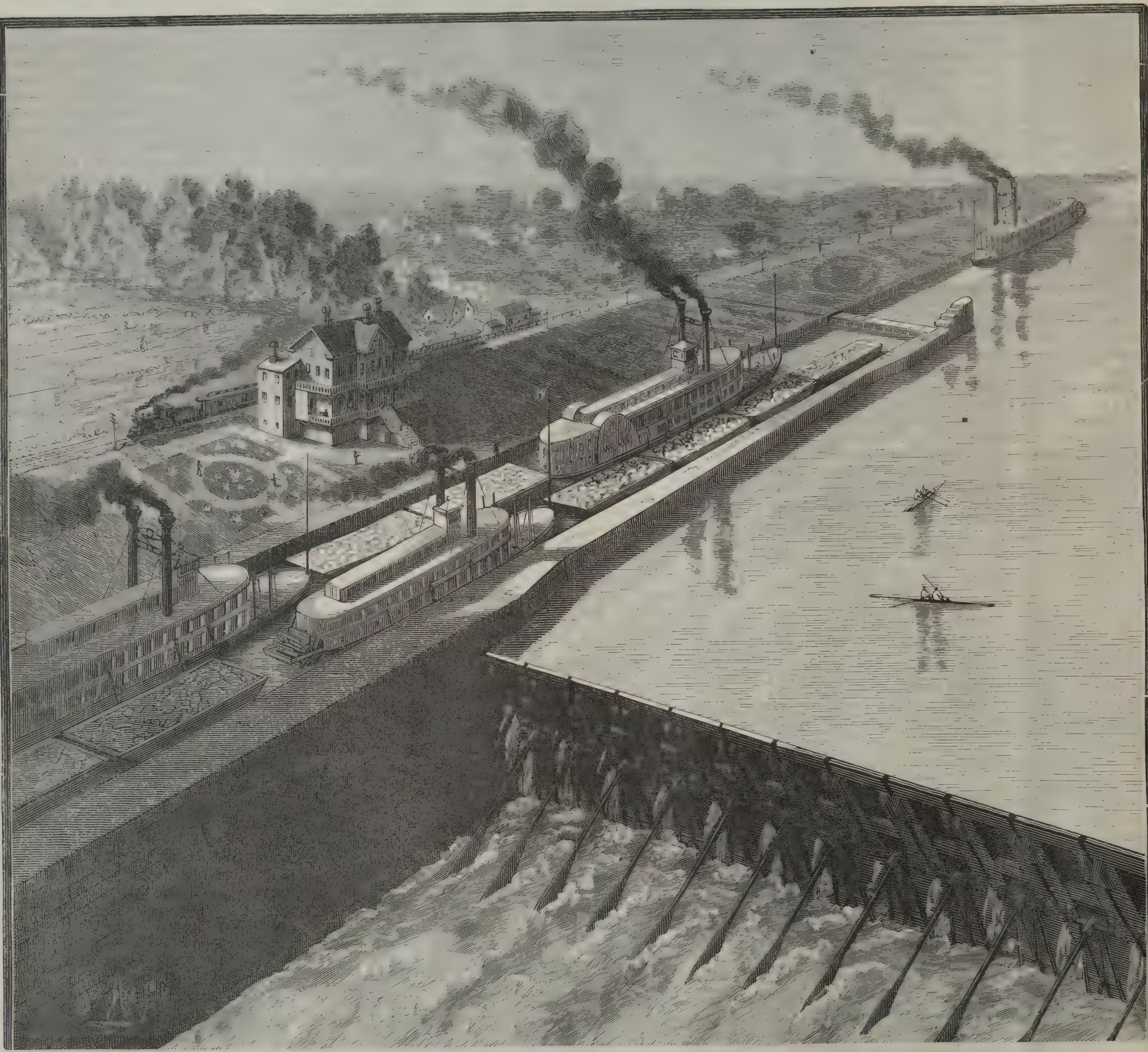
THE GOVERNMENT WORKS ON THE OHIO RIVER.

In the olden days, when Fort Duquesne was on the extreme colonial frontier, the restless waters of its two encircling rivers met below the old fort to form the broad Ohio, and together flowed toward the sea in unrestrained freedom. In winter and spring mighty torrents rushed hurriedly past the fort and onward to the great valley. In summer and autumn, when heat and drought had quenched the tributary fountains, these torrents were replaced by broad, shallow streams, scarcely navigable for heavier craft than the frail canoes that formed their only fleet. But when the old fort had grown into a famous trading post, and then into a brisk city, this intermittent navigation became extremely disadvantageous. The large mineral resources of Western Pennsylvania were being developed, and their product of coal and iron distributed throughout the South and West by means of the natural waterways afforded by the Ohio and Mississippi.

Pittsburg's commerce had stretched out its hands until her steamers had gone into the Northwest as far as the Upper Missouri, a distance of 4,300 miles, and on the South as far as New Orleans and the Gulf. Each year the traffic grows larger, until at the present time the tonnage of the port of Pittsburg exceeds that of New York.

Its growing requirements strongly demand improved facilities of water communication. The Monongahela has already been made navigable for many miles above the city by an elaborate system of fixed dams and locks. The Allegheny remains for the most part unimproved. Penetrating, as these rivers do, to the North and South, they bring a large region of rich and productive country into communication with the city at their mouths, and further improvements to navigation will extend the area of the tributary district. But the actual port of the city has not until recently been free from the interruptions caused by the low water of summer.

The only practicable way of improving it lay in damming the Ohio, and so raising the water level. But it would have been a manifest disadvantage to turn this immense tonnage through a lock all the year round in order to make the traffic continuous from one ice-bound season to the next. The two conditions necessary to be considered—an open passage at high water and a navigable pool surrounding the city and extending as far down the river as possible, at all seasons of the year—made a movable dam highly desirable. It was, therefore, decided to construct a wicket dam, on the plan devised by M. Chanoine, by which the river could be left open at high water, and during the dry season could be so far confined as to make a navigable pool surrounding the city.



MOVABLE DAM ON THE OHIO RIVER AT DAVIS ISLAND.

Davis Island, five and a half miles below Pittsburg, was chosen by the Government engineers as the site for such a dam. The work was begun in August, 1878, and finished last fall. It was formally opened on October 7. A channel-way, 456 feet wide, between Davis Island and the southern shore, has been closed by a permanent dam. The main channel of the river, between the island and the northern shore, is 1,344 feet wide. It is across this water-way that the movable dam has been constructed. A lock, 689 feet long and 110 feet wide, has been built on the northern shore. A land wall, having a total length of 1,649 feet, extends along the bank. A wall of solid masonry, 19½ feet high, 11 feet wide at its base and 8 feet on top, sepa-

THE GOVERNMENT WORKS ON THE OHIO RIVER.

(Continued from opp. page.)

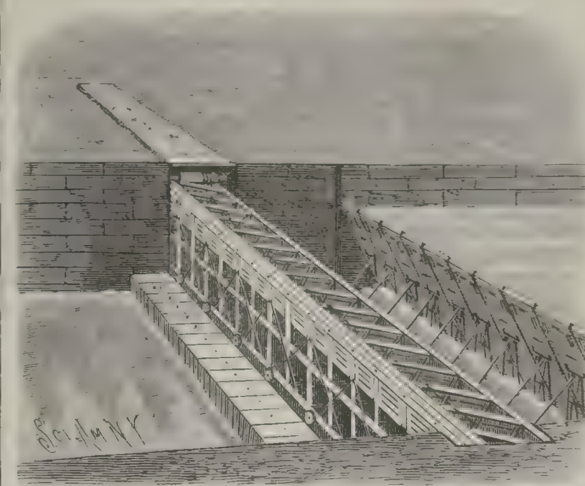
rates the lock from the river. Between the wall and the island the channel is divided into the Pass, 559 feet wide, and three weirs of 224, 224, and 216 feet respectively. The weirs are separated from each other and from the ship channel—the Pass—by masonry piers. The dam consists of a series of 305 movable wickets, which lie flat on the river bed during high water, and are only raised into position when the river has fallen so low as to make navigation difficult or impossible.

The wicket consists of three parts—the wicket proper, the horse, and the prop. The wickets are made of white oak, and are 3 feet 9 inches wide. Their length varies from 12 feet 11 inches in the Pass to 9 feet 9 inches in the weir nearest the island. They are placed 4 feet between centers, thus leaving a space of 3 inches between them, through which the overflow water passes. When the river is too low to permit this waste, pieces of scantling are put down over the openings, the weight of water being sufficient to hold them in place. The wicket is journaled to the horse at a point just a little above its center. The lower part of the wicket is weighted, in order to keep it down. The horse is a frame of wrought iron, 6 feet 8 inches long, which is journaled in a cast iron box in the bottom of the river. These horse boxes are fastened to stout timbers on the river bed, which in turn are secured by iron rods, 9 feet long, to a buried timber which serves as an anchor.

The prop is journaled to the crosshead of the horse, its free end being supported, when the dam is up, by means of the Pasqueau "hurter." This ingenious device is a cast iron box, 9 feet long and open at both ends, which rests upon the bottom of the river. When the wicket is raised into position, the end of the prop slides along the bottom of the box, and up a slight inclined plane occupying one-half the width of the bottom, until it reaches the end of the plane and drops down into a notch, where it is held by the pressure of the water against the wicket.

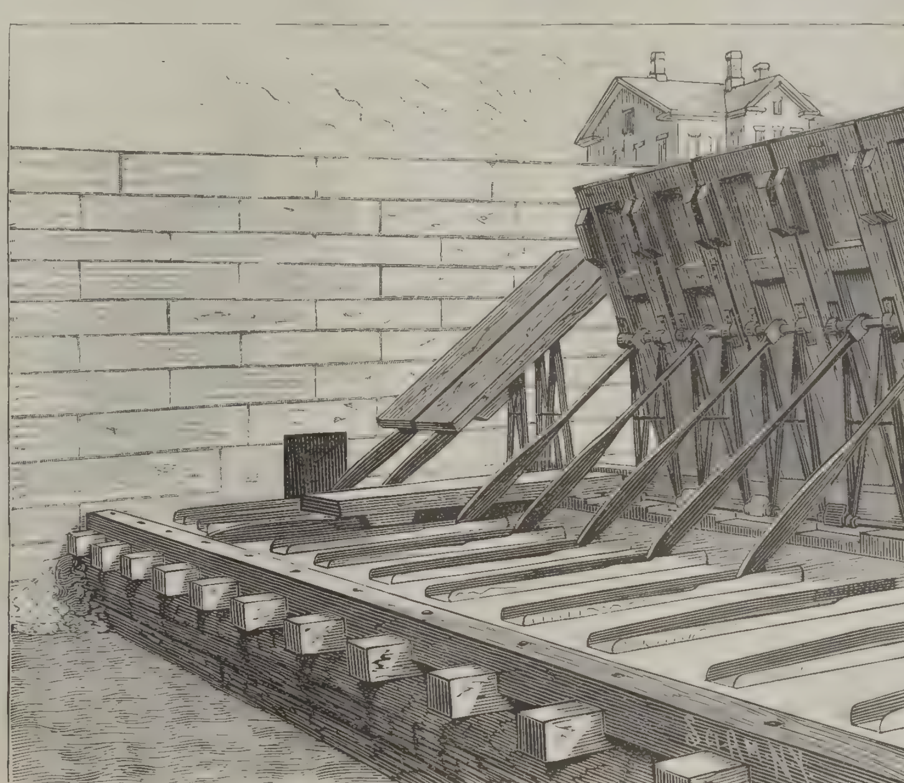
When the wicket is to be lowered, it is pulled forward slightly until the prop is disengaged from the notch and falls to the bottom of the hurter. As the wicket is lowered, the end of the prop, guided by a beveled edge, slides to one side of the inclined plane, and so along the bottom of the hurter until prop, horse, and wicket are flat on the bed of the river. The Pasqueau hurter, like the entire system of wicket dams, is a French invention. Its characteristic feature, upon which the Pasqueau patent was taken out, is the beveled edge, by which the end of the prop is guided to one side of the inclined plane, and permits the wicket to be lowered.

The wickets across the navigable pass are operated from a "maneuvering boat." In closing the dams, a hook is inserted in the lower end of the wicket. This is then drawn forward until the prop falls into the notch in the hurter, the wicket proper remaining all the time like a feathered oar, with its broad side parallel to the current. When the prop is securely in place, the lower end of the wicket is gradually allowed to sink until it rests against a sill in the bottom of the river. The wicket must be held by the hook until it rests against the sill, otherwise the force of the current would soon prove destructive. When the dam is to be lowered, a hook is inserted into the upper end of the wicket, and, by means of a windlass on board the boat, is drawn in until the prop is disengaged, and allows the whole affair to sink to the bottom. Both in raising and lowering the dam each wicket is operated separately. The system of wickets in the weirs is precisely similar to that in the pass and across the head of the lock, but is operated from a "service" bridge in place of the boat. This bridge is a light iron structure, some feet above the dam, and when not in use collapses at right angles to the current. It is built in sections, as shown in our illustration, and stands 15 feet 1⅜ inches above the river bed. The supports are 8 feet apart, and are hinged at their lower ends to suitable sills. A section of flooring sufficient to span the intervening space is hinged to each support, and goes down with it. A chain connects the free end of the flooring section with the adjoining support nearest the island. When collapsed, the sections lie flat on the river bed, overlapping each other, after the manner of a fallen row of bricks. When the bridge is to be erected, the section nearest Davis Island is first put in place, and by means of the chain connection, the succeeding ones are one by one brought into position. The supports projecting from the upper side of the piers are in the line of the bridge, and divide it into three larger sections, corresponding to the weirs.



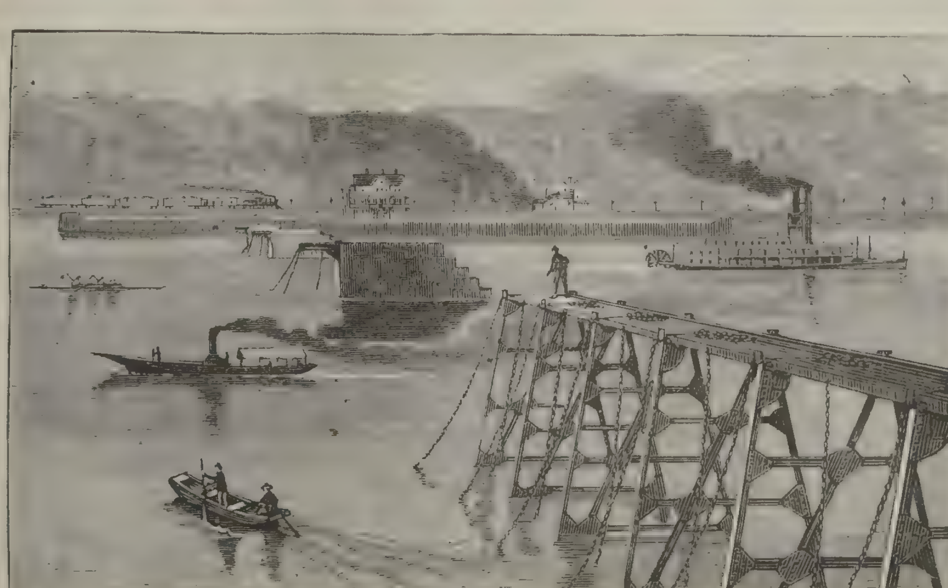
UPPER GATE AND SHORE RECESS.

The lock, in addition to several novel features of construction, possesses an interest as being the largest, both in length and breadth, in the world. A dam of 27 wickets extends across its upper end. This is only brought into requisition when the lock is first used or taken out of use. It is for the purpose of giving slack water in the locks, as it would be impossible otherwise to operate the gates. While the lock is in use, the weir will be unnecessary, as the water will always be slack, either the upper or lower gate being at all times closed.



VIEW FROM BELOW SHOWING THE WICKETS IN DIFFERENT POSITIONS.

The gates are alike, except in the arrangement of their valves. They are 14 feet high, 13 feet 7⅝ inches wide, and 118 feet long. They are formed of several Howe trusses laid horizontally, and connected by a heavy timber framework. Each gate runs on a track, and when the lock is to be opened, is drawn into a corresponding recess in the river bank. In the lower gate there are 14 butterfly valves, 38 inches in diameter. These are all connected with one shaft, and operate in unison. In the upper gate there are no valves. Each shore recess is provided with seven discharging butterfly valves, 4½ feet in diameter, and in the river wall there are also seven valves, 4½ feet in diameter, making the filling and discharging area of the valves the same. A turbine wheel in the river wall is operated by the water entering the lock through these valves, and its power is utilized to pump water into two tanks on the bank, which have a total capacity of 79,000 gallons. When full, these tanks give a fall of 64 feet, and serve to operate a turbine at each gate. In this manner all power required by the lock is furnished by the river. The turbine at the upper gate is smaller, because less power is required to move the gate. Being so largely of timber, the gate will almost float; and being at the same time so nearly submerged, it has little weight, and requires therefore but little power to operate it. The lower gate, however, is different. It moves almost entirely out of the water, and requires a larger turbine for its operation.



SERVICE BRIDGE AND PIERS.

The work of building the Davis Island dam has been subject to a great many interruptions and delays. It has cost the Government about nine hundred thousand dollars. It is presumed that the annual maintenance will be about six thousand.

When the dam is up, it gives back water on the Monongahela to Dam No. 1, a distance of 6½ miles, and on the Allegheny to 36th Street, a distance of 7 miles. This makes a depth of 12 feet at the dam and about 6 feet at Pittsburg, giving a pool, therefore, which is navigable in the driest seasons. The dam will only be used for a few months during the summer. Some idea of the enormous tows that pass down the Ohio at this point can be gained from considering a single instance, where 22,000 tons of coal were carried at one time to the markets further down the river. Such a cargo is greater than the famous Great Eastern ever handled, and it is worthy of note that the expense of transportation is lower than in any other system of carriage on record. The coal barges carry about 500 tons each, and the boats about 760 tons. Lashed together, three abreast, and lying low in the water, they look at some distance like immense rafts. The tow boats are large stern-wheel vessels, requiring only about two feet of water. They are always placed back of the tow, and when traveling in a current of much velocity present a curious picture, their large wheels revolving in a reverse direction in order to bring the tow to a controllable speed.

The enormous traffic on the Ohio has reached such a stage that it warrants the systematic improvement of the river in every possible way. The dam at Davis Island is an experimental one, inasmuch as it will probably determine the system of improvement on the entire Ohio. Should it prove successful, similar dams, on the Chanoine system, will be built at various points to the mouth of the river at Cairo. So far, the success of the Davis Island dam, as well as the four on the Kanawha River, has been such that there is little doubt that the system will be widely extended. Forty such wicket dams have been mentioned as being necessary to bring the river into a series of continuously navigable pools between Pittsburg and Cairo.

In addition to its commercial importance, the Pittsburg pool will be the scene of considerable yachting, and already the builders of pleasure craft report a noticeable increase in their business. The slack water and long stretch of several miles make it admirable ground for the oarsman.

AMERICAN TIN.—A 9,000-pound mass of tin ore was recently exhibited at a smelting works in New York. It was taken out of a 29-foot vein in the now well-known Etta tin mine, in the Black Hills. The specimen will be sent to London for the benefit of those British tin-mine owners who have so complacently watched our heretofore unsuccessful search for the metal.

WOOD WOOL.

For some time past there has been found in the market a very interesting product consisting of extremely thin and slender shavings of wood, that are comparable to paper cut for packing, and that go by the name of "wood wool" This product was first introduced into France as a packing material. It weighs about forty or fifty per cent. less than the materials generally used for such a purpose. Its beautiful appearance, its fineness, and its extreme cleanness at once brought it into favor with shippers. It was afterward found that the material was well adapted for the manufacture of mattresses, for bedding for cattle, for the filtration of liquids, and for stuffing horse collars, etc., the most suitable species of wood being selected for each of these purposes. Its elasticity causes it to be considered as the best material for bedding, after horse hair; and it is even preferable to any other substance when it is derived from resinous wood, since it does not then absorb moisture.

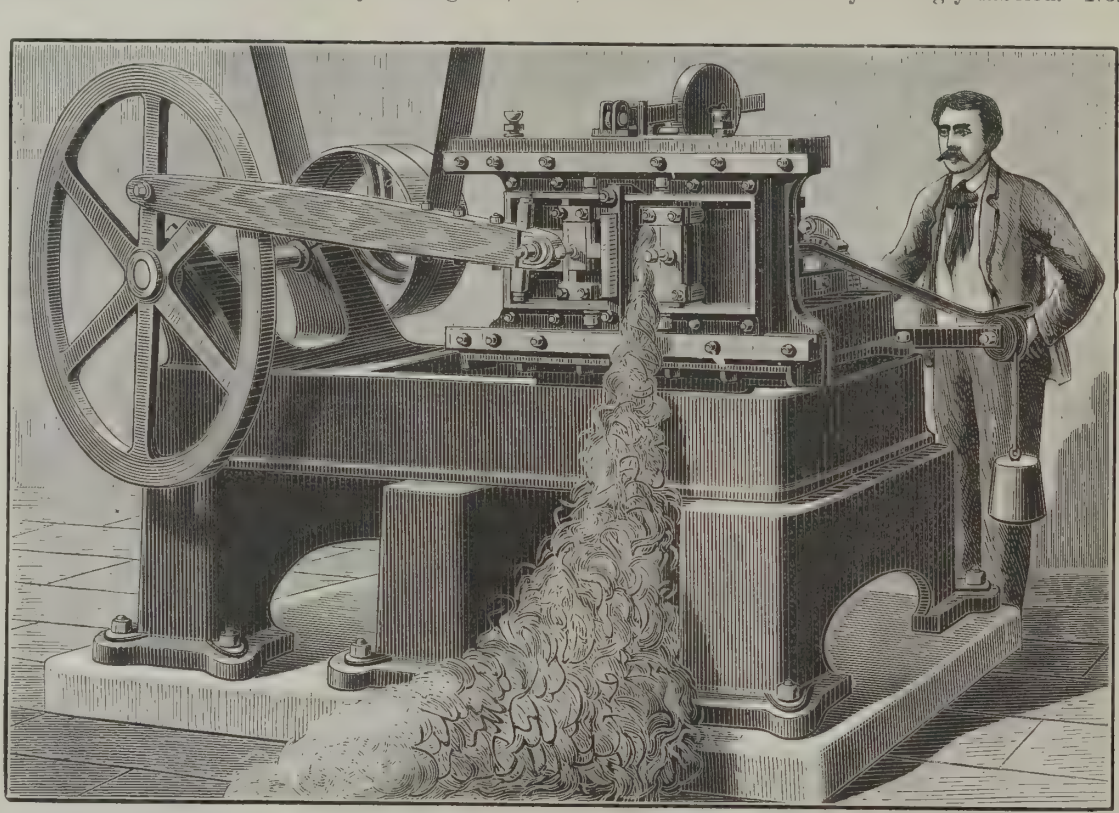
In workshops, wood wool is tending to replace cotton waste for cleaning machines, and it has likewise found an application on the rolling stock of railways for lubricating car axles. While it has the same property that cotton waste has of absorbing oil, it costs ten times less than that material.

All these advantages explain why the use of it, which is so extensive in America, is rapidly becoming general in Austra and Germany, and is beginning to extend in France.

The accompanying engraving represents a new machine for the manufacture of this interesting product. It consists of a cast iron frame resting upon three supports of the same material, and carrying a driving shaft, which is actuated by two pulleys, fast and loose. To this shaft there is fitted a flywheel, one of the spokes of which is provided with a pin that receives one of the extremities of a connecting rod, while the other extremity of the same is connected with the knife carrier. This latter, which also rests upon the iron frame, slides in iron guides, and carries a set of peculiar knives arranged in such a way that the wood is cut in both the backward and forward motions of the knife carrier.

The wood is held upright on the machine by a lever with a counterpoise, and on the sides by a stop at one side and a movable jaw at the other, that permits of introducing blocks of a few fractions of an inch in length. The wood is shoved forward under the knives by means of a click, that causes it to advance the requisite distance at every revolution of the flywheel. The wood used by preference in this machine is Riga fir. The blocks of wood must, at a maximum, be 0·465 millimeter in length 0·4 millimeter in width, and 0·32 millimeter in thickness, and consequently the most economical and practical thing to do is to purchase commercial fir planks (which are 0·32 millimeter in width and 0·08 in thickness) and cut them to the desired length of 0·465 millimeter. In this way it becomes possible to operate upon four superposed pieces of wood at once.

It takes a power of about four horses to actuate this machine. The production may reach 1,500 or 1,700 pounds of "wool" per day of ten hours. It is unnecessary to have a special workman to run the machine; any intelligent man can operate it.—*La Nature.*



MACHINE FOR MAKING WOOD WOOL.

Circumstantial Evidence.

The danger of relying too strongly on circumstantial evidence in murder trials was forcibly illustrated recently in the case of Miss Journeaux, on the island of Jersey. This lady, it will be remembered, went out for a short row with a male companion named Farne, and after they had rowed some distance he lost his oars overboard, and leaped into the water to regain them. He could not get back to the boat, as the tide was running rapidly, and Miss Journeaux soon lost sight of him, though he managed to reach the shore. This was on Sunday night, and the poor girl drifted helplessly about in the frail bark until Tuesday morning, when she was picked up by a French fishing vessel of St. Malo. She was kindly treated by the captain and crew, and landed, after a voyage of twenty-six days, on the shore of St. George's Bay, Newfoundland, from whence she was sent to St. John's to wait for a vessel bound to France. In the mean while Farne was arrested for murder, and imprisoned, and was not set at liberty until a telegram arrived announcing the safety of his former boating companion.

How different matters might have turned out if Miss Journeaux had been lost at sea! He might have been hung for a crime which he never committed, and all his protestations of innocence would have been regarded as the wild pleadings of a man who desired to escape the just penalty of his misdeeds. No power on earth could probably have saved him, and he would probably have gone down to posterity with the brand of Cain upon his brow. Only the interposition of Divine Providence seems to have saved his neck from the halter. The opponents of capital punishment will find a strong argument in this case for the abolishment of the death penalty.

Famous Gold Nuggets.

At the Colonial and Indian Exhibition, under the auspices of the British Government, a case of models of famous gold nuggets has been exhibited. Below is a list and description of the more important ones, with valuation of the originals.

No. 1--The Welcome Nugget, found at Ballarat, June 11, 1858, on the Bakery Hill lead, at a depth of 180 feet, by a party of twenty miners, who were reworking the ground a second time. As an illustration of the chances of gold mining, it is known that, when the lead was first worked by small parties on small claims of 24×24 feet, this nugget was missed, and that a drive had been run along so close to it that there was a mark of a pick that had evidently been struck into it by the miner who first passed it.

As may be imagined, there was intense excitement by the miners who were working in the mine while they were unearthing it. When suddenly come upon, a small portion of the nugget was first seen, and, when found immovable, raised the hopes and anticipations of the miners working in the face of the drive, and their companions, who, working in other parts, had all run to have a look, or lend a hand in unearthing the beautiful monster. The mine being in the town of Ballarat East, the news of the discovery spread with wonderful rapidity, and thousands soon rushed to see the Welcome nugget—then the largest and handsomest piece of gold ever seen. It was taken to the bank, cleaned, and weighed, and for some time was on view to the public. The weight of the Welcome nugget was 2,195 oz., and its value £8,780. It was well named. This was, however, eclipsed some eleven years after by the finding of a still larger one by two poor miners at Dunolly, in 1869, the model of which is on the wall of quartz at the side of the court—apparently an unconsidered trifle. It was found within a few feet of the surface, and was named the Welcome Stranger. Its weight was 2,248 oz. of pure gold, and its value £9,534, being 53 oz. heavier than the first one, and the largest lump of gold ever found. So far as regards the division of profits, the finders of this—being only two men working as mates --had more advantage than the larger party of twenty men among whom the value of the other one had to be divided.

The Welcome Stranger nugget was for a long time publicly exhibited, and paid the proprietors handsomely. No. 2 (in the case) is the Precious nugget, found at Berlin, January 5, 1871, at a depth of 12 feet from the surface, its weight being 1,717 oz., and value £6,868. No. 3—The Viscount Canterbury, found at Berlin, May 31, 1870, at a depth of 15 feet from the surface, its weight 1,121 oz. 10 dwt., and its value £4,420. No. 4—The Viscountess Canterbury, found at a depth of only 6 feet 6 inches, weighed 896 oz. 15 dwt., and its value was £3,536. The Berlin gold field was prolific in big nuggets, and another one, No. 6, called the Kum Tow nugget, was found by a party of Chinamen at Berlin, August 17, 1871, at a depth of 12 feet 6 inches, its gross weight being 795 oz. 19 dwt., its value £2,872. No. 5—The Schlemm nugget, found at Dunolly, July 11, 1872, at a depth of only 3 ft.; weight 538 oz. 5 dwt., and its value £1,912. No. 7—The Platypus nugget, so called from being somewhat the shape of that curious creature, was found at Bendigo, in March, 1861, at a depth of 5 feet; weight 377 oz. 6 dwt., and its value £1,508. No. 8—The Beauty, also found at Bendigo, in 1858; weight 242 oz., value £968. No. 9, found at Buninyong, July 11, 1878, at a depth of 3 feet; weight 250 oz. 15 dwt., value £920. No. 10—The Spondulix, found at Eureka Gully, Ballarat, in November, 1872, at a depth of 8 feet; weight 155 oz. 10 dwt., value £520. No. 11—The Little Highlander, found at Corindhap, July 18, 1878, at a depth of 40 feet; weight 175 oz. 18 dwt., and value about £700. No. 12—The Christmas Gift, found at Corindhap, December 12, 1877, at a depth of 40 feet; weight 176 oz. 18 dwt.; value a little over £700. No. 13—A nugget found at Wedderburn, August 9, 1880, at a depth of 330 feet; weight 99 oz., value about £380. No. 14—The Needful nugget, found at Berlin, May 10, 1871, at a depth of 12 feet; weight 249 oz., value £984. No. 15—Found at Majorca, July 24, 1879; weight 90 oz. 9 dwt., value —. No. 16—The Inglewood nugget, found at Inglewood, in January, 1881; weight 201 oz. 16 dwt., value £800. No 17 is a handsome nugget found at Wedderburn, but evidently wrongly labeled. No. 18—A nugget found at Sandhurst, December 28, 1877, at a depth of 9 feet; weight 75 oz. 5 dwt., value £292. No. 19—Nugget found at Homebush, March 24, 1880, at a depth of 140 feet; weight 111 oz. 19 dwt., value £440.

Various other nuggets, or rather models, are also represented, giving a good idea of the state in which gold is found. There are also the models of several very large and valuable nuggets on the wall of quartz, but no intimation of their history.

Staining Oak or Ash.

An excellent recipe for staining oak or ash brown may be made by mixing linseed oil and benzine in equal parts, and adding burnt umber or Vandyke brown. Maple may be stained a green-gray color by using copperas in water. Oak will also be changed to a dark green-blue color by the same means. Ammonia applied to oak produces the bronze-olive tint now used so much by architects. Staining by the fumes of ammonia results in all shades, from light olive to deep brown of extreme age. This method is considered the best for imparting to oak or mahogany the appearance of age.

The Law as to Party Walls.

A party wall in law is the wall dividing lands of different proprietors, used in common for the support of structures on both sides. At common law, an owner who erects a wall for his own buildings which is capable of being used by an adjoining proprietor, cannot compel such proprietor, when he shall build next to it, to pay for any portion of the cost of such wall. On the other hand, the adjoining proprietor has no right to make any use of such wall without consent of the owner, and the consequence may be the erection of two walls side by side, when one would answer all purposes. This convenience is often secured by an agreement to erect a wall for common use, one-half on each other's land, the parties to divide the expense; if only one is to build at the time, he gets a return from the other party of half what it costs him. Under such an agreement, each has an easement in the land of the other while the wall stands, and this accompanies the title in sales and descent. But if the wall is destroyed by decay or accident, the easement is gone, unless by a deed such contingency is provided for. Repairs to party walls are to be borne equally; but if one has occasion to strengthen or improve them for a more extensive building than was at first contemplated, he cannot compel the other to divide the expense with him. In some States there are statutes regulating the rights in party walls, and one may undoubtedly acquire rights by prescription on a wall built by another, which he has long been allowed to use for the support of his own structure.—*Building.*

A $2,000 DWELLING

This design was prepared for the *Mechanical News* by Mr. J. F. Brown, of Toronto, Ontario. It is an economical and attractive plan.

The foundation is of stone, the walls 16 inches thick, laid in good mortar and neatly pointed; the chimneys of sound hard burned brick, and good mortar; the entire first and second stories lathed and plastered with best two-coat work.

The outside finish is of best quality pine, clapboards of sound spruce, and shingles of clear cedar. The gutters and conductors, and the deck of bay window, are of galvanized iron. The floors are of sound spruce, 5 inches wide—yellow pine in dining-room, kitchen, and veranda. The inside finish is of well-seasoned pine, the stairs of pine, with cherry newel-post and hand rail. All the exterior is painted except the roof; the parlor, dining-room, and hall are stained and varnished, and all other work painted with two coats of white lead and oil, in such tints as may be desired. The plumbing comprises suitable bath tub, wash bowl, and closet fixtures in the bath-room, cast-iron sink in the kitchen, and the necessary waste pipes, traps, etc.

The height of ceilings is—in cellar, 6 feet 3 inches; first floor, 9 feet; second floor, 8 feet; attic, 10 feet to the ridge board. The attic is not finished, but this can, of course, be done whenever desired, though not included in the present estimate.

The Parthenon.

"The appearance of Parthenon," says Lamartine, "testifies more loudly than history itself to the greatness of the Grecian people. Pericles will never die! What a civilization was that which found a great man to decree, an architect to conceive, a sculptor to adorn, statuaries to execute, workmen to carve, and a people to pay for and maintain such an edifice! In the midst of the ruins which once were Athens, and which the cannon of the Greeks and Turks have pulverized and scattered throughout the valley, and upon the two hills on which extends the city of Minerva, a mountain is seen towering up perpendicularly on all sides. Enormous ramparts surround it; built at their base with fragments of white marble, higher up with the debris of friezes and antique columns, they terminate in some parts with Venetian battlements. This mountain seems to be a magnificent pedestal cut by the gods themselves, whereon to seat their altars." Here it was that the Parthenon towered—nay, towers still, even in its ruins, above the Pentelic valleys, the plain of the Piræus, and the sea, where shine the pediments of the temple of Jupiter Æginus.

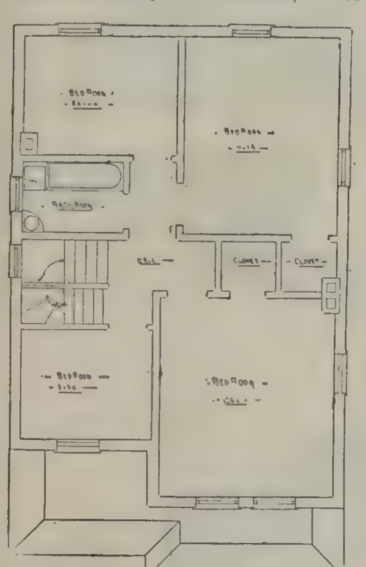
"By what fatality," exclaims Chateaubriand, "is it that these masterpieces of antiquity, which the moderns travel so far and undergo so many fatigues to behold and admire, owe partly to the moderns themselves their destruction? Down to the year 1687 the Parthenon remained entire. The Christians converted it first into a church, and the Turks, jealous of the Christians, afterward converted it into a mosque. Then came the Venetians, in the highly civilized seventeenth century, and cannonaded the monuments of Pericles. They shot their balls upon the Propylæum and the temple of Minerva; a bomb sunk into the roof, set fire to a number of barrels of gunpowder inside, and demolished in part a building that did less honor to the false gods of the Greeks than to the genius of man. The town being taken, Morosini, with the design of embellishing Venice with the spoils of Athens, wished to take down the statues of the pediment of the Parthenon, and broke them. A modern succeeded in achieving (in the interest of the arts) the destruction which the Venetians had begun. Lord Elgin lost the merits of his commendable enterprise in ravaging the Parthenon. He wished to take away the bassi-rilievi of the frieze; in order to do so, he employed Turkish workmen, who broke the architrave, threw down the capitals, and smashed the cornice."

Numerous descriptions of the Parthenon, by writers of antiquity as well as travelers of all ages, enable us to reconstruct it for the mind's eye in its general aspect, and almost in all its details.

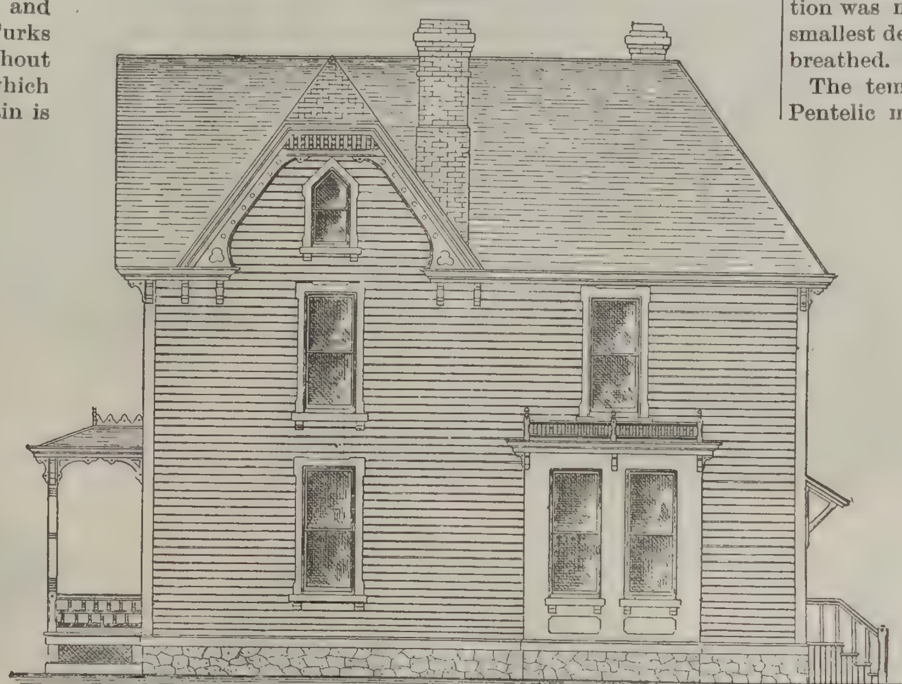
The ancient sanctuary of Minerva had been so completely annihilated by the Persians of Xerxes that Themistocles did not hesitate to employ the remains in the construction of ramparts. Pericles charged Ictinus and Callicrates, under the direction of Phidias, to raise a new edifice worthy of the power of Athens and of her goddess. The architects adopted the Doric style, on account of its nobleness and simplicity; but they reserved the privilege to themselves of lightening its somewhat squat proportions, and softening its rudeness by precise and finished work. Inspired with the idea of the object of the work—the honor of Minerva herself—they never lost sight of the divine virgin, whose glorious image Phidias fixed in marble, as she sprang from the forehead of Jupter—the issue of supreme thought—an ideal in which strength did not exclude grace. In every part of the architecture the highest degree of elegance and serenity was conspicuous. Without sacrificing any of the traditional merits of the Doric order, they subordinated them to the idea which it was necessary to embody. Columns of greater length than formerly supported bolder capitals and a lighter entablature; a richer and more delicate decoration was made use of in the friezes, and in the very smallest details the loftiest and most purely Attic spirit breathed.

The temple, 234 feet by 98 feet, entirely of white Pentelic marble, was surrounded by a peristyle, sustained upon forty-six columns, eight supporting each pediment. The columns, placed without pedestals upon three steps, measured 20 feet high and nearly 6½ feet in diameter. Forty-six to forty-eight colossal figures, about 13 feet in diameter, admirably grouped, formed the pediments, and were relieved in pure white upon a reddish back ground. Below, between the triglyphs, painted in blue, ran upon the ninety-two metopes of the exterior frieze those famous alti-rilievi, the Centaurs and the Lapithæ, Hercules and Theseus, Perseus and Bellerophon, by Phidias. Amid the gods and heroes a place was reserved for men. The principal episodes of the battle of Marathon, won by the Athenians over the Persians, occupied the metopes of the western facade. Outside the colonnade, upon the exterior wall of the temple, ran a long frieze, embracing subjects treated in alto-rilievo, like cameos.
—*R. Donald, Wonders of Architecture.*

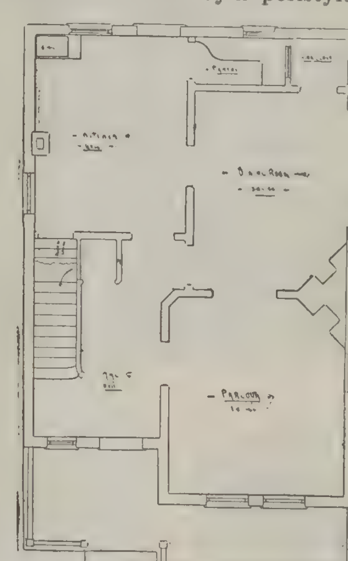
— Front Elevation —



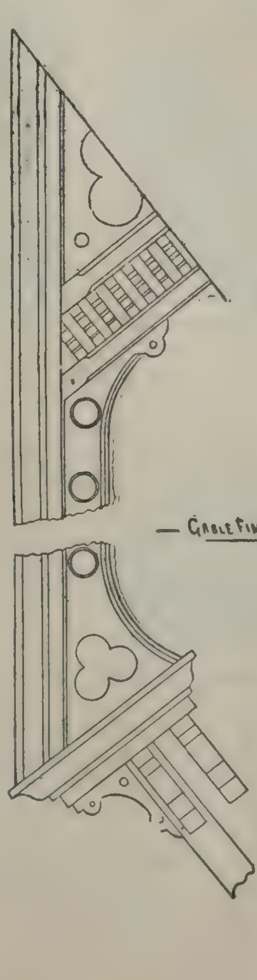
— Second Story —



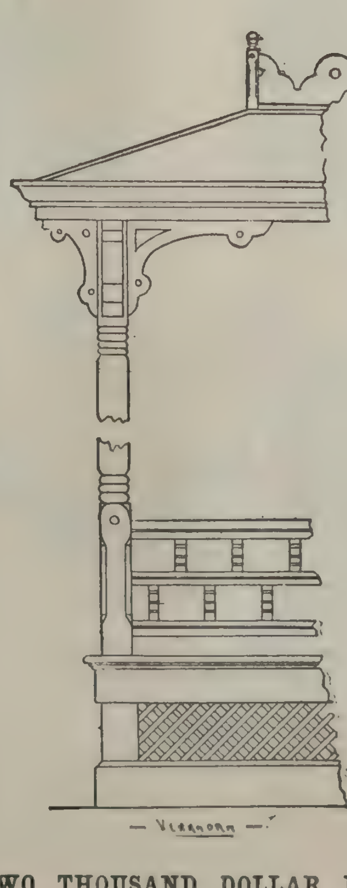
— South Elevation —



— First Story —

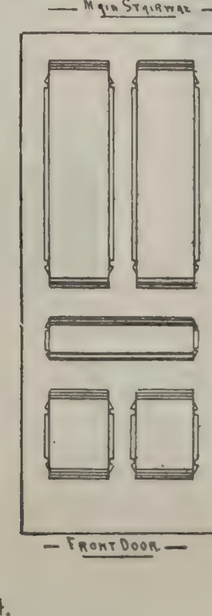


— Gable Finish —



— Veranda —

— Main Stairway —



— Front Door —

A TWO THOUSAND DOLLAR DWELLING.

PORTABLE BUILDINGS.

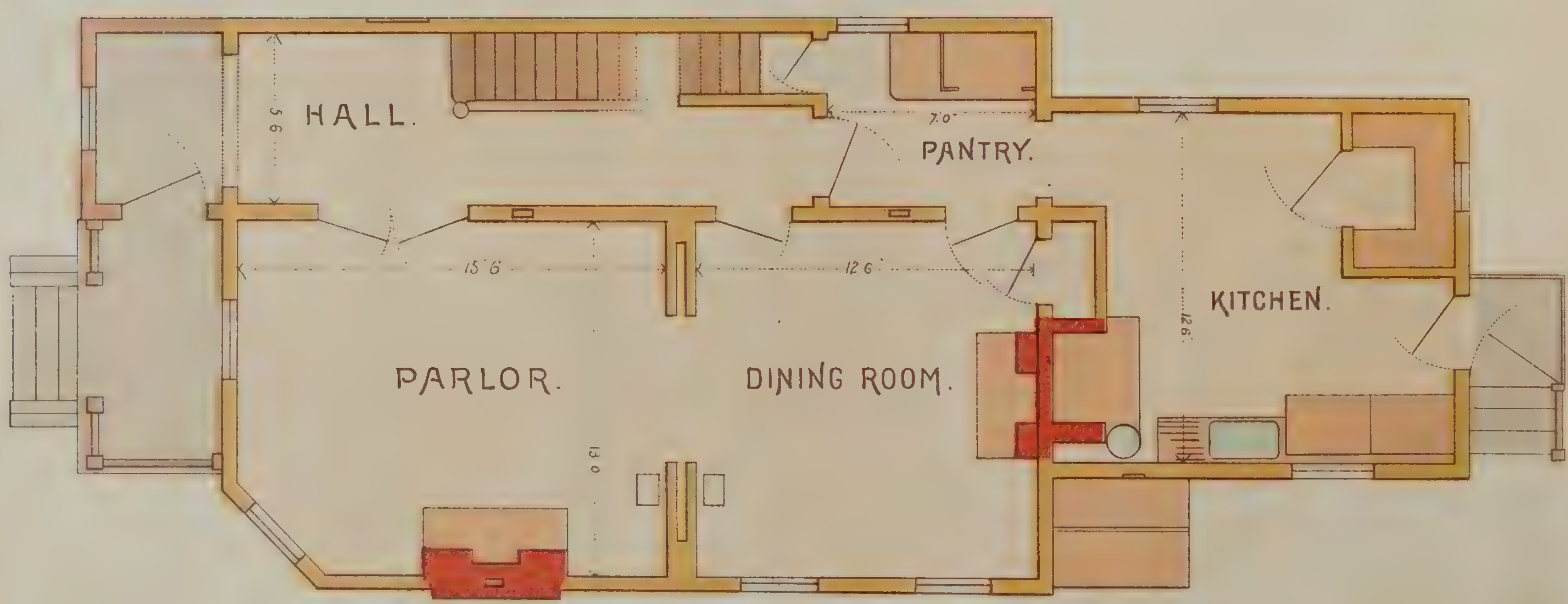
The Society of the Red Cross in Europe has, for several years, given particular attention to the subject of portable field hospitals and other improved appliances for the care of sick and wounded soldiers. Though the more humane method of settling international differences by arbitration is appealing each year with increasing earnestness to the conscience of Christendom, there is still an immense field for the ministrations of those who seek the conservation of life in the midst of its military destroyers. Despite the deadliness of modern instruments of warfare, it is conceded that a greater proportion of soldiers die from lack of sufficient care and from exposure than from the immediate effects of the bullets of the enemy. There is, therefore, every inducement to reduce this unnecessary fatality by providing proper shelter and treatment for both the wounded and the strong. With the charitable purpose of lessening these dangers, an exhibition was held at Antwerp on the 1st of September, 1885, under the auspices of the Society of the Red Cross, and the inventors of the world were invited to contribute the products of their ingenuity. The object of the exhibition was to develop the best possible design for a barrack or field hospital, which might be utilized either in war or in time of peace. The requirements of the proposed structure were as follows:

"The barrack should be capable of being easily converted into a hospital, and *vice versa;* it should be so constructed that it could be set up and taken down with ease, transported without difficulty, and, as far as possible, interchangeable in all its respective parts, and should be able to resist the varying temperatures and withstand the violence of the wind; it should be waterproof, and so simple in its construction that no skilled workmen would be necessary in its manipulation."

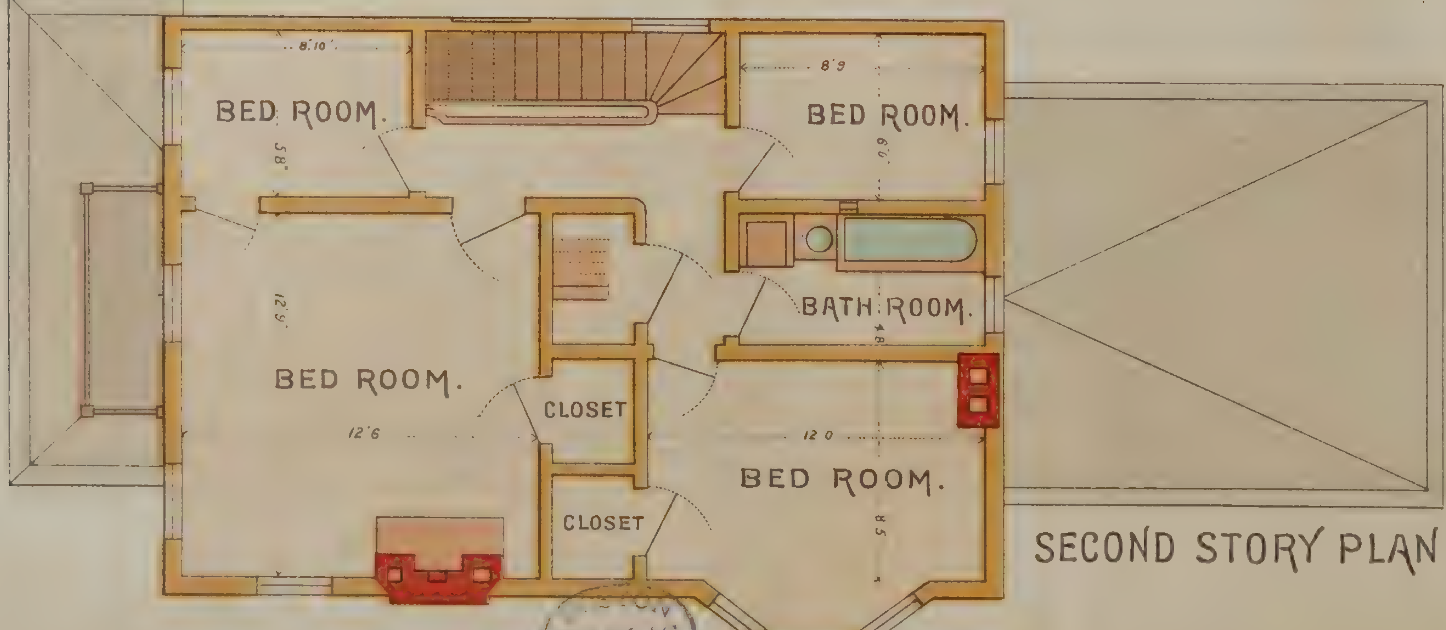
A circular containing these requirements having come into the possession of Mr. Wm. M. Ducker, of Brooklyn, he addressed himself to the solution of the problem, and in a short time produced a structure in accordance with the specifications of the society. He forwarded a full sized model to Antwerp, where it was placed on exhibition, in competition with seventy-six other designs from all parts of the world. Mr. Ducker's model attracted much attention, and was very favorably commented upon by the medical and military gentlemen acting as judges. It is a representative American invention, for it combines in an eminent degree lightness and portability with strength and convenience. In recognition of his valuable services in the interests of humanity, Mr. Ducker received a silver medal, contributed by the Empress of Germany, and has also been honored by a message from the Emperor congratulating him upon the excellence of his design. He is now in correspondence with several European governments, with reference to the adoption of his

ILLUSTRATIONS OF PORTABLE BUILDINGS.—DUCKER'S BARRACK AND FIELD HOSPITAL.

A DWELLING AT FLATBUSH, N.Y. H. L. HARRIS, ARCHITECT, N.Y.



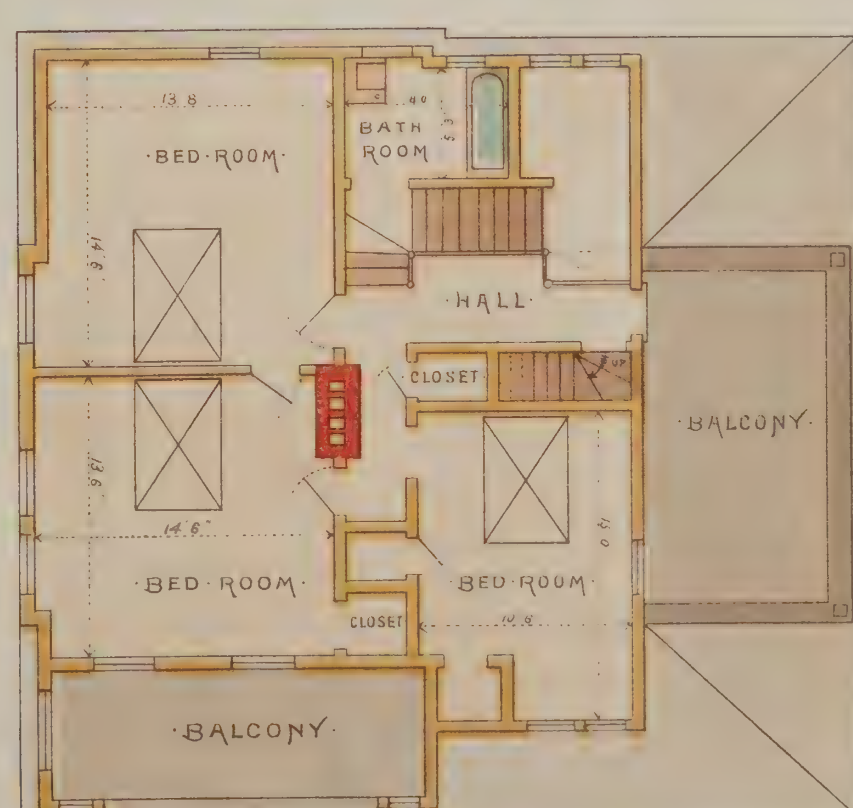
FIRST STORY PLAN.



SECOND STORY PLAN.

A COTTAGE AT MONNMOUTH BEACH, N.J. T.A. ROBERTS & SON, ARCHITECTS, NEWARK, N.J.

·FIRST FLOOR PLAN·



·SECOND FLOOR PLAN·

barrack in their respective countries. The merits of Mr. Ducker's design lie in the care with which all the details have been worked out, for, apparently, no condition has remained unsatisfied.

We show in our illustration an exterior view of the barrack as set up for use, its appearance when loaded on a truck ready for transportation, the medal awarded by the Empress, the interior of the barrack when used as a hospital, the manner of erecting the structure, and the details of its construction. The main building is 34 ft. long and 17 ft. wide. The height is 10 ft. 3 in. at the ridge pole, and 6 ft. 6 in. at sides. It is built in sections, for convenience in transportation, and can be put up without the use of nails or screws. Two men can erect the barrack without the least difficulty, and in little more than an hour's time, as all the parts lock into each other and are perfectly interchangeable. Each side consists of six double sections. These are made of strong, light frameworks of wood, hinged together, and covered on the outside with leather board or other light waterproof material.

To each double section there are attached, as shown, a bed, table, and chair, while in the panel over the table there are a glass window sash, opening inwardly, and a slatted shutter opening outwardly. During transportation the hinged section is shut together, inclosing these several articles and protecting them from damage. The end of the barrack is also made in sections. The ridge pole is divisible into two or three parts, and is provided with suitable slots, into which the rafters are keyed. When the structure is set up, a standard army duck roof extends over all. The floor is made in similar sections, which key into the sides and into a central longitudinal shaft. The floor being 8 in. above the ground, all dampness is avoided. The central shaft is provided with three registers, and may be used either for hot or cold air, or for disinfectants. Ordinary inequalities in the ground are provided for by adjustable feet attached to the side sections and to the floor. In addition to the main structure, there is a small annex at each end, to be used for heating and other purposes.

Each barrack, it will be seen, thus gives sleeping accommodation for twelve men. Every provision has been made for the comfort of the invalid. A rope suspended from the rafter over the bed permits him to raise himself; a chair back is provided when he wishes to sit up; a small slate is tacked over the bed to receive any memoranda the physician or nurse may want to make. In short, the barrack is remarkably complete. And yet, when ready for transportation, it weighs, with all its furnishings, only about 2,500 pounds, and has the great advantage of being all in large pieces. There is absolutely nothing to get lost, for everything is fastened securely in place. It is also probable that the barrack will be utilized to some extent by the health authorities of several American cities, in order to provide comfortable temporary hospitals in case of epidemics. It furnishes, indeed, pleasant accommodation for a number of purposes, where shelter of a temporary or semi-permanent character is required. The inventor is to be congratulated for the distinction he has won in the face of European competition and for the material aid he has rendered to those whose mission it is to save life.

A WAGON WHEEL WITHOUT AXLE.

The yearly exhibit of agricultural machines at the Palace of Industry, Paris, usually furnishes its quota of new and interesting mechanical inventions. Among these we shall cite two in particular which are peculiarly interesting, for they concern objects that did not appear to be capable of modification—we mean the ordinary wagon wheel and the trundle for moving goods about.

The new wheel, which was exhibited by Mr. Suc, and is shown in Figs. 1 and 2, entirely dispenses with axle, grease boxes, journals, axle boxes, etc. The part A of the wheel is permanently fixed to the frame of the wagon, which is moved forward through the rotary motion of the external felly, B, which forms a sort of circular rail around A, and rests upon the ground. It thus substitutes a rolling friction at the circumference for the sliding friction of journals in their boxes.

The principle of the wheel is as follows: If we place two grooved rails on the ground, and insert in the grooves a number of steel balls, T, that are held at equal distance apart in the apertures of a guide, C, and then place two grooved rails over the whole, in such a way that the groove shall embrace the balls, and if we then cause the two upper rails to slide over the lower ones (which remain stationary), the movement will be effected through the simple rotation of the balls. If, now, we curve the whole, we shall have a wheel in which the rail, A, will form the stationary felly, and will be encompassed concentrically by the guide, C, containing the balls, and externally by the rail, B, which in this arrangement becomes movable.

The two inner rails that form the felly of the two opposite wheels are fastened to the wagon frame that they support, while the external ones remain free to revolve. The wheel is provided internally with iron or wooden cross-braces, or iron plates even in order to give it sufficient strength, and is attached to the wagon by springs, the number and arrangement of which may be left to one's choice. This is an advantage not possessed by wheels with axles, which latter are necessarily con-

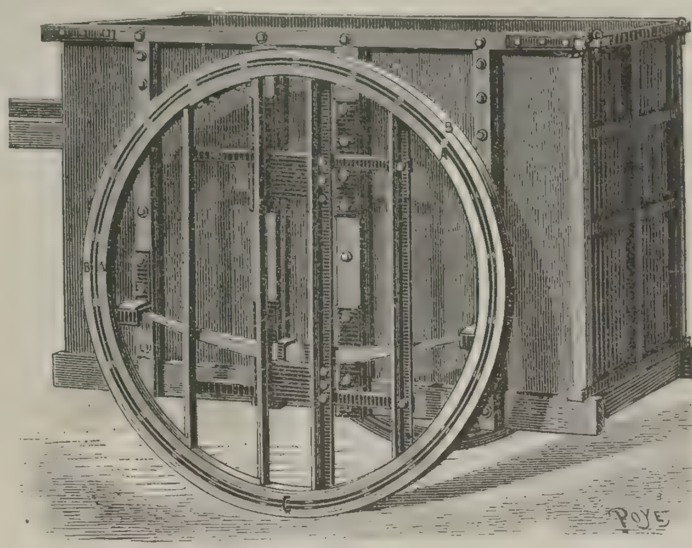


Fig. 1.—WHEEL WITHOUT AXLE.

nected with the wagon by a spring that rests upon the grease box of the axle journal.

Let us add, finally, that with this arrangement the wagon may be made to sit as low as may be desired. The wheel may be applied to all kinds of vehicles, and thus, through the lowering of their bottom, give them a stability much greater than they would otherwise have. The bottom of the wagon may be brought close to the ground, and consequently permit aged or infirm persons to get into the vehicle without any trouble. Security against accident is in this way obtained, since the fall to be feared is, so to speak, *nil*.

Doubtless the drawback to the general application of

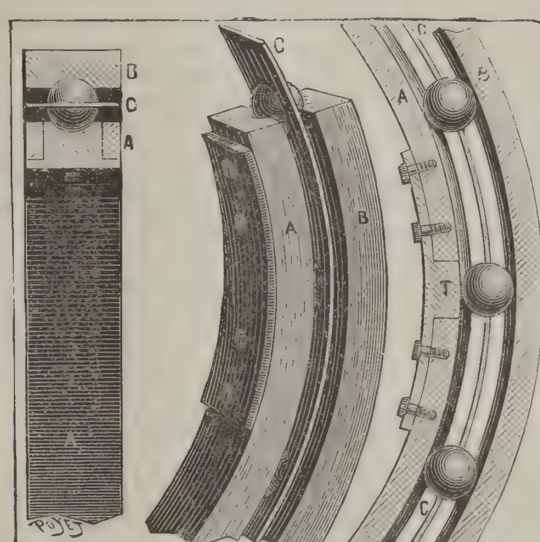


Fig. 2.—DETAILS.

this ingenious arrangement will be the complication of the felly, and especially the difficulty of preventing mud from accumulating in the grooves in rainy weather, when the streets are dirty. Mud and sand cannot help interfering with the rotation of the balls, and causing enormous friction.

It would be interesting at all events to have the results of some comparative experiments that would permit of estimating the tractive stress required by this style of wheel, as compared with that of the ordinary type, in streets paved with wood or stone or macadamized, or on roads in an ordinary state of repair.

As belonging to Mr. Suc's exhibit, we must also mention a new style of trundle for moving goods about.

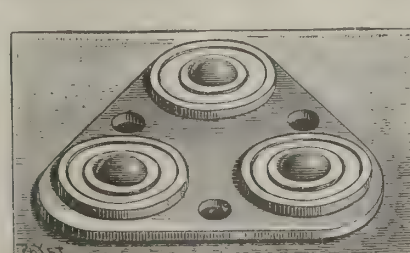


Fig. 3.—SUC'S TRUNDLE.

This is shown in Fig. 3. It consists of three balls, 3½ inches in diameter, whose centers are held in an unvarying position at the apices of an equilateral triangle. These balls move between two disks that are riveted to a piece of iron plate which connects the whole affair. They readily yield to the stress that is exerted upon them, whatever be its direction, since any two of them can always pivot around the third. They are to go on the bottoms of boxes, crates, platforms, etc.

Fire Escapes.

After each large fire wherein the inmates of buildings, being cut off from egress, meet with fatal results, there is a general cry for a more rigid enforcement of the law compelling owners of large blocks and hotels and workshops to erect suitable fire escapes. Now, the question arises, What constitutes a suitable fire escape? In the first place, I would like to argue *pro* and *con* regarding the fire escape that is generally used now—a common iron ladder bolted either to the front or side of a building, as an example we will say a hotel. Now, in case of a fire, this is all that is desired to save a man's life under certain conditions: that is provided a man is a sailor, used to climbing, and also that he sleeps in the same room that the ladder reaches. But with circumstances other than these, a ladder is a mere mockery, for the following reasons: It is never to be supposed that one woman or child in a hundred would have presence of mind enough to first find and then descend a ladder. Again, the persons whose rooms the ladder reaches, upon retiring lock and bolt their doors, and very likely in case of fire will quickly descend the ladder, leaving those whose rooms are not so favorably situated to escape as best they can. I have never yet learned where a stationary ladder was the means of saving human life.

The Milwaukee hotel fire, a few years ago, gives us a good example of the inefficiency of the stationary ladders upon that building. Nearly all the inmates were so excited that they could not act for themselves, but even those who would do so were driven back by the dense smoke, and in order to keep from suffocating were obliged to stay at the windows, and as a result were slowly burned to death. At a recent fire chiefs' convention, the opinion was given that a fire escape that depended upon the inmates of buildings for action was practically useless.

What is needed is an escape that is manipulated by persons on the ground—one that can be raised, lowered, and moved to any window in the building, and rescue three or four men, women, or children at one time. There are patent fire escapes innumerable, some embracing ideas that are without doubt very ingenious, but they all contain this one great fault, they are not handled by persons on the ground. Again, architects and builders should take into consideration the fact that fire escapes, as they are now made, are not an enchancement to the good appearance of buildings.—*F. C. B., Amer. Builder.*

What a Frenchman Can Do with a Hair.

Of Gen. Von Manteuffel, the late German military governor of conquered Alsace, who hated all that was French, it is said that he once, at a public dinner, engaged in a dispute with a French diplomat who maintained the superiority of the French workmen over the artisans of all other countries. "A thing so ugly does not exist that the skill and genius of a Frenchman cannot make of it a thing of beauty," he said. Angered by the contradiction, the old soldier pulled a hair from his bristly gray mustache, and, handing it to the Frenchman, said curtly, "Let him make a thing of beauty out of that, then, and prove your claim.' The Frenchman took the hair and sent it in a letter to a well known Parisian jeweler, with a statement of the case and an appeal to his patriotic pride, giving him no limit of expense in executing the order. A week later the mail from Paris brought a neat little box for the General. In it was a handsome scarf pin made like a Prussian eagle, that held in its talons a stiff gray bristle, from either end of which dangled a tiny golden ball. One was inscribed "Alsace," and the other "Lorraine;" and on the eagle's perch were the words, "You hold them, but by a hair."

A CUPBOARD IN FRETWORK.

BY J. W. GLEESON-WHITE.

One of the most useful odd pieces of furniture in a room is a small cupboard, large enough to take the little bottles and boxes that lurk on the mantel piece or hide in the corners of the sideboard cupboards for want of a convenient place to disappear, and yet be at hand when wanted; especially is this the case in a bedroom, as hardly any one is so favored by health as to be entirely free of pill boxes or small bottles of remedies from toothache to the more serious of the maladies that modern life is subject to. Therefore I think that no apology is needed for suggesting a form so destitute of novelty as a small hanging cupboard. I have hesitated to call it a medicine cupboard, as it may be used for any other purpose equally well; but no doubt the owner will soon find a use for it; and I fancy that few articles would find more favor at a bazar or be more welcome as a birthday or other present, by high, low, young or old, than some such sort of cupboard as this one.

To describe at length making a cupboard of this sort seems to be almost superfluous, as any one who is not frightened at the thought of building a rabbit hutch—and that, I fancy, includes at least the English speaking youth throughout the world—may pluck up courage, and attempt such a one as this.

First, the choice of wood is unlimited, and may be left free to the would-be maker. Whatever it is, it will need two stout pieces, not necessarily over half an inch in thickness, for the sides. If the fretwork is added at the top, as shown, these may be cut bracket fashion below, and the top left plain; or, better still, the fretwork (if convenient) worked in the piece itself. These two pieces may be screwed, in lieu of better fitting, to three other pieces, placed shelf-fashion—one just above the top of door, one midway, the other just below the door. If these "wobble" when fixed—though they ought not to do so—a back of thin boards nailed on, with the edges beveled to avoid unslightly appearance at the sides, will assist in keeping them taut and firm. The door may be cut in one piece; but, if within the bounds of possibility, let it be a nicely paneled frame, with the two openings filled with the fretwork; cut about ¼ to ½ inch of square margin round the panels, and let in (like glass) to rabbets in the framing, or, better still, put in grooves proper panel fashion, if it can be done.

It is needless to say that the more workmanlike a finish is made, the better will be the result, and the suggestions for the simpler way may be treated with the contempt they deserve by those who are able to go to work in a professional way.

The fretwork looks well if painted with the bronze powders now literally sold everywhere; these may be applied the last thing. Supposing, for instance, the cabinet is ebonized, and the fretwork bronzed, let the leaves be all green of different shades in the design; the fruit gold, shading to crimson; the flowers silver, shaded with pink; the lattice of a diaper pattern, plain gold. This will make the whole thing quite in keeping for drawing room ornament, and add to the effect of the fretwork greatly. If bronzed, either glass or polished wood, black (of course), may be put behind the fretwork, both to strengthen the work and to keep the dust from the contents of the cupboard.

A turned balustrade might be used in place of fretwork rail to the top, with good effect, and the lower part might carry a narrow shelf below the door, some 5 inches down, the brackets being shaped to take it. If this is so, the space between shelf and cupboard should be boarded and lined with looking glass, plush, or velvet, to make the whole look like one piece of work, and not like an afterthought.

Ornamental hinges, an escutcheon for keyhole, and ring handle, would be better, if attainable, but are not necessary. If used as a medicine cupboard, it is suggested that the shelves should have a low piece of plain wood as a rail in front, to prevent a sudden jar tilting the bottles off the shelves. The shelves themselves should be arranged to take bottles of various heights, while a very low shelf should be left for pill boxes and small pots.

As space is valuable and folding sheets limited in number, the working drawings of the fretwork ledge surrounding top of cupboard (Figs. 2 and 3), and the panels forming the cupboard door (Figs. 4 and 5) are given quarter size. They can be easily enlarged to full size by means of the pantograph, or by making a tracing and dividing it into squares. Thus, if the illustrations be divided into squares measuring ¼ inch each way, the squares of the full sized working drawings should be 1 inch each way. The general appearance of the cupboard when complete may be gathered from the sketches of the front and side given in Fig 1.—*Amateur Work.*

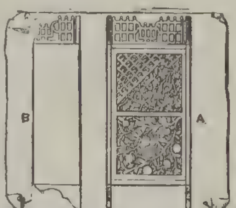


FIG. 1.—FRONT (A) AND SIDE (B) OF CUPBOARD.

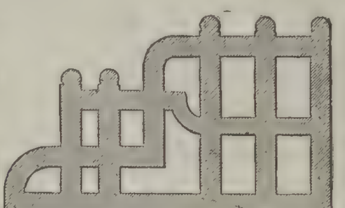


FIG. 2.—SIDE OF LEDGE AT TOP OF CUPBOARD—¼ SIZE.

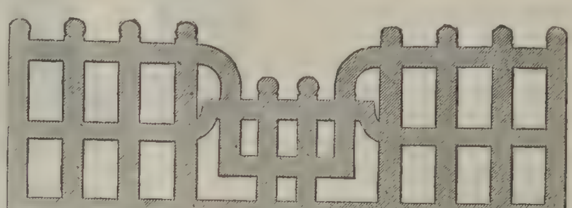


FIG. 3.—BACK OF LEDGE IN FRETWORK AT TOP OF CUPBOARD—¼ SIZE.

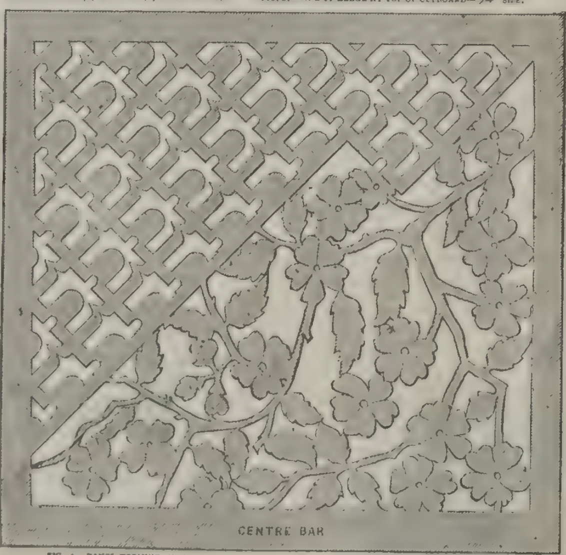


FIG. 4.—PANEL FORMING UPPER HALF OF CUPBOARD DOOR, INCLUDING BAR IN CENTRE—¼ SIZE.

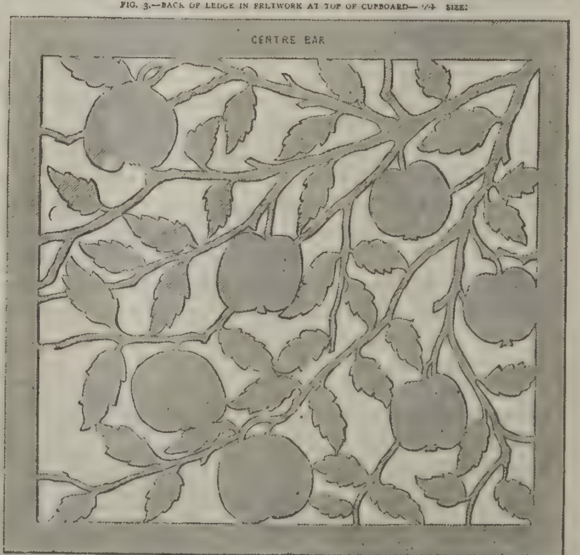
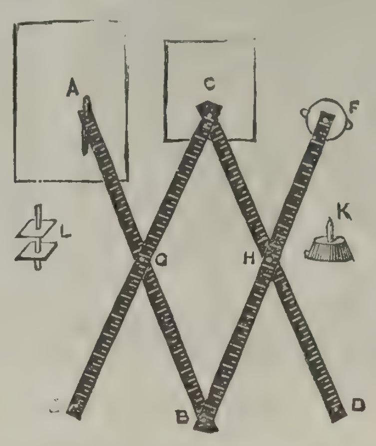


FIG. 5.—PANEL FORMING LOWER HALF OF CUPBOARD DOOR, INCLUDING BAR IN CENTRE—¼ SIZE.

A HANDY CUPBOARD IN FRETWORK.

THE PANTOGRAPH.

To make a pantograph, first take four flat sticks of equal length—size or material does not matter—and plane them up true and smooth. At an inch from each



SKETCH OF PANTOGRAPH.

end of the sticks bore a hole just large enough to hold a piece of brass or other tubing, whose internal diameter is that of a pocket pencil. Into one end of each stick fit a section of the tube, opening the edge as in eyeleting, to prevent the ring so made from slipping out. Take a pair of the sticks, and hinge them together at the ends which have not been so treated with a piece of tube, eyeleting as before. Hinge the other pair together in the same way. Now take a block of wood, of any shape you please, but not more than two inches across; bevel it round its upper edge, and through its center; from the back, drive an inch screw whose threaded part will just fit into the holes in the sticks. For the tracer or style, take a similar screw, and cut off its head by filing the smooth part down to a point. Slip the screw into the hinge of one of the couples, and keep it in its place by a leather washer above and below, making the distance between the under side of the wood and the point exactly that of the thickness of the block. Now get half a dozen one-half inch round-headed dresser hooks, and put the apparatus together, as shown in the diagram, where B and C are the points at which the sticks are hinged. Slip one of the legs over the block, F, and screw it down so that it will move freely with a leather washer. Place the leg, C D, under F B, and screw it into position from the upper surface with one of the dresser hooks. Place C E over A B, and screw it into place with another hook from above. The third hook is beneath the apparatus, close to B; the fourth beneath, close to A; and the fifth and sixth are used to screw the block on to the drawing board, and are put in on the bevel, so that their heads will not project above the face of the block. The tracer is screwed, point downward, at C; the pencil is at A and pencil tracer, block, and hooks at A and B are all of equal length, so that the machine moves evenly over the drawing board. To enlarge the drawing, the distance from F to C must be less than from F to A; to reduce the drawing, the distance must be greater, which is done by putting the tracer at A and the pencil at C. In shifting the pencil, move the hook, which is put close by to steady it with.

What $120 did in a Cottage at the Thousand Islands.

Thirty-one dollars went into the sitting room, and never came out; $18.00 sat down round in the form of rattan rockers, two painted in cherry and interwoven in the back and arms with pink tissue paper rolled tightly, two in black, with yellow, and two in the original, with blue; $5.00 lay on the floor in golden brown and seal checked matting; $4 00 looked very cheery in 49 cent yellow China pongee, hung with small brass rings on a bamboo cane, covering a number of shelves, on which were the light novels of the day; $0.75 dropped into the carpenter's hand when the last nail was driven in a tete a-tete, and $2.60 looked radiant in its light flowered, cretonne covered cushions; $1.00 in two gilded kitchen stools, gayly decorated at the top of each leg with different shades of tissue paper. In the dining room, $8.00 was metamorphosed into eight pine chairs, varnished with white varnish, which, with a cushion, each covered with a different shade of China pongee silk, and tied to the legs with a pretty bow, looked well worth the money; $6.00 appeared very substantial in dining table; $1.50 in a leather lambrequin, around a wide shelf, cheaply does the service of a buffet, and seemed proud of the family silver; $2.60 in 2½ cent cheese cloth and lace, used as sash draperies in all the windows, gave a clean cottage prettiness to the whole house; $16.00 in an ivory white painted bedroom set lighted up the cherry stained walls and floor of the first bedroom. The opposite room appeared cool and sweet, with its walls of baby blue and $16.00 set of the same hue. The golden brown and seal matting, 31¼ cents per yard, left $25.00 to skip into the next room and be changed into an ash stained set and cherry colored matting. When the summer came around, the boys of the family shouted with joy, "Hurrah for the Thousand Islands!" The girls danced with glee, and the proud father called from the deck of the boat, as he waved his hand in farewell to his friend on the shore, "Come up and see us now, Robert, in our island home." The friend enviously muttered under his teeth, but he never knew that the "island home" only cost $620 to build and furnish.—*The Decorator and Furnisher.*

Illumination at the City of Mexico.

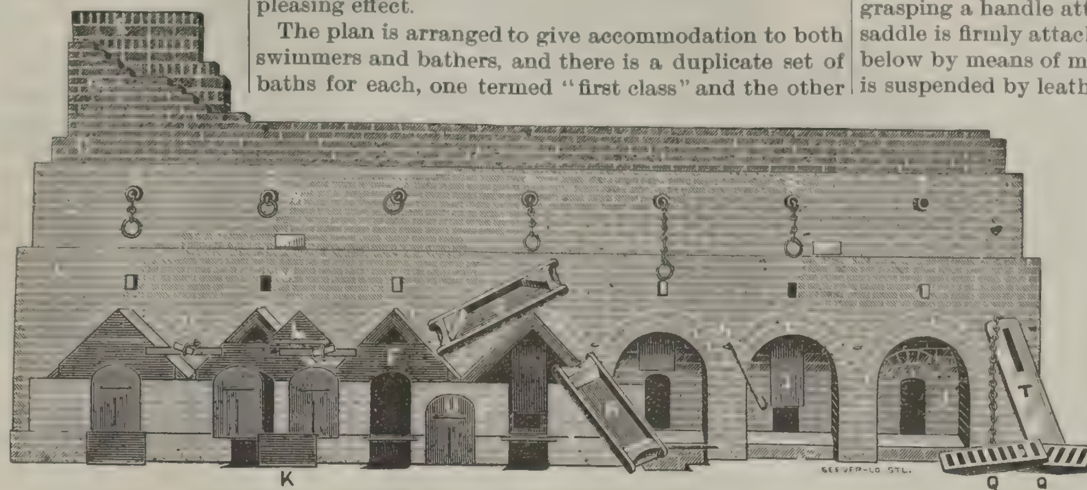
The city of Mexico, being one of those places on the border-line between enlightenment and barbarism, is provided (says *Engineering*) with very good illumination under circumstances of great difficulty. The long transportation and high tariff raise the price of kerosene oil to 1 dol. per gallon for the same quality as is sold in the United States for 10 cents per gallon. Illuminating gas is sold at 7½ dols. per 1,000 cubic feet, and is not generated from coal, but from a resin brought into the city on the backs of Indians. The rarity of the atmosphere at an elevation of 8,000 feet above the sea reduces the intensity of combustion to such an extent that both gas and oil give much feebler flames than near to the sea level—probably less than two-thirds of the same illuminating power. This rarity of the air, however, increases to some extent the apparent brilliancy of electric lights, which are widely introduced when the circumstances are considered. The lights are introduced as the beginning of a system which will eventually comprise 80 high towers, carrying four arc lamps of 4,000 candle power each. The present cost of electric illumination is excessive, as in Mexico coal costs 22 dols. per ton, and wood 12 dols. per cord. Careful consideration is, however, being given to plans for the utilization of peat bogs near the city as a source of fuel for the electric light stations.

To take mildew out of a tent, mix well together a spoonful of table salt, 2 of soft soap, 2 of powdered starch, and the juice of a lemon. Lay on both sides of the stain with a painter's brush, and then expose the tent out of doors day and night until the stain disappears

AN IMPROVED KILN.

Mr. George M. Harris, of Pawnee City, Neb., has lately patented the improved form of kiln for burning bricks, tiles, potter's ware, and lime which we illustrate in the sketch herewith.

The clamp wall, A, B, C, D, is built in varying thicknesses and with end offsets, and the bricks, E, or other material to be burned are set up in the usual manner. In the inner portion of the clamp wall are provided openings or ducts, as shown on the right of the sketch, to admit the hot air to the bricks, and these openings may be closed by the dampers, I, which are raised or lowered by chains. Small peep holes, M, covered with glass, are provided over each of the ducts, being perforated through the wall, so that the material being burned may be viewed.



HARRIS' IMPROVED KILN.

In front of the arched portion, J, is formed the low wall, L, which incloses the grate of the furnace, and is covered in with two inclined slabs on top, and with the horizontal slab, F, in front, fixed with the rods and bars as shown on the left hand of the figure, and forming, with the inclined slabs, a triangular space for the admittance of cold air, the entrance of which is regulated by the dampers, L. The wall, L, is provided with openings, which may be closed by the movable door, U, and the pit door, K. The inclined slabs and the slab, F, are formed of common clay in the moulds, R, S.

The principal advantages of this kiln are that the admittance of the hot and cold air may be regulated in the most exact manner as may be required with different materials or at different periods during the process of burning; the movable doors, U and K, permit free access to the furnace fire, and the brick clay slabs may be used for different kilns as often as required, instead of building separate furnaces, as has been hitherto done in setting up brick kilns.

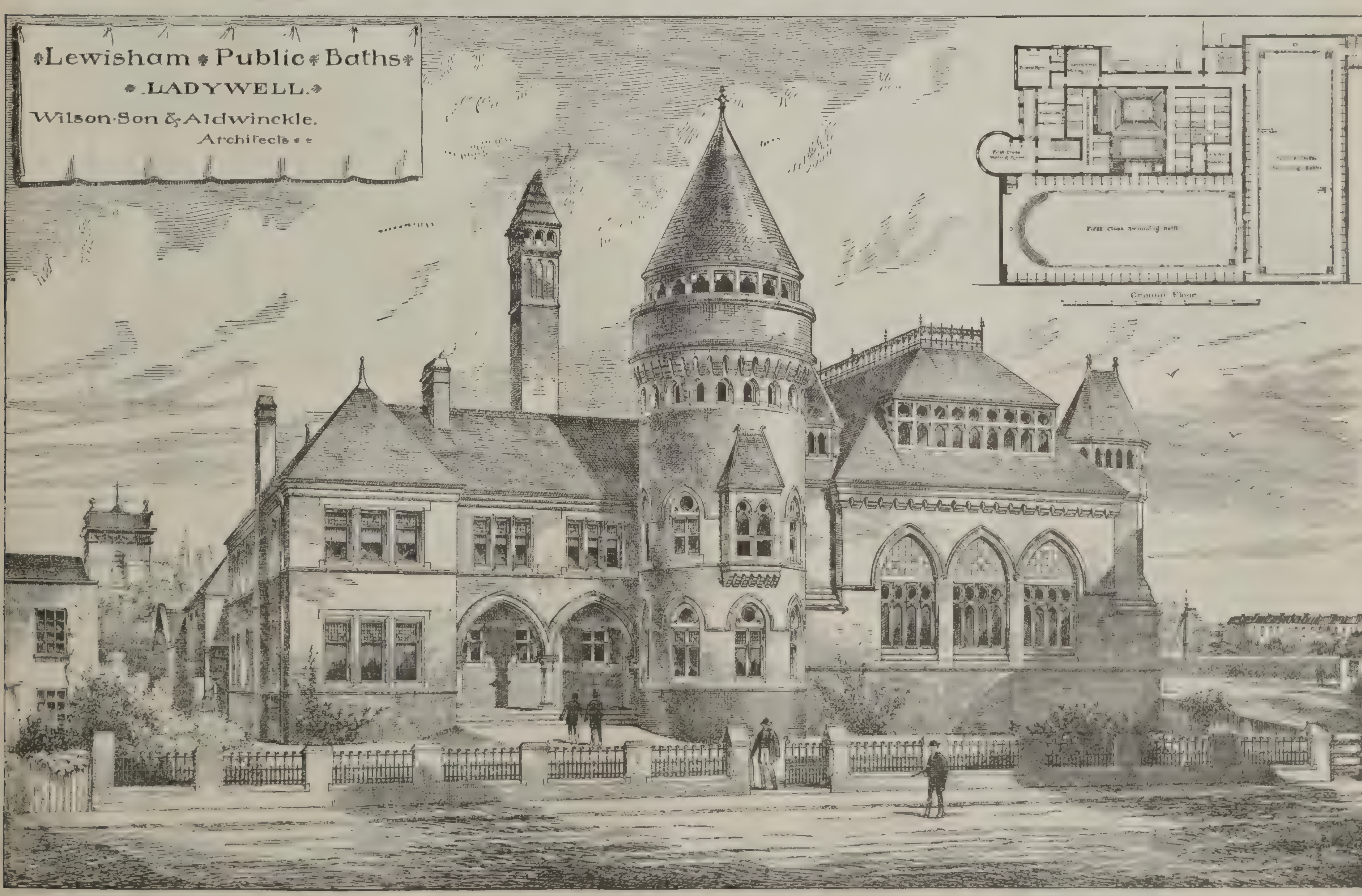
LEWISHAM PUBLIC BATHS.

In England most towns have swimming and washing baths, many of them very handsome buildings, and in London they may be found in every district. As a rule, they are erected and maintained by the parochial authorities.

The design illustrated in the accompanying drawing represents the public baths recently erected at Ladywell, a portion of the parish of Lewisham, in Kent, and a suburb of London. The elevation is in red brick, relieved with stone dressings and trimmings. The fine tower at the corner adds much to the importance of the building, and the stained cathedral glass inserted in the windows over the transoms helps to produce a pleasing effect.

The plan is arranged to give accommodation to both swimmers and bathers, and there is a duplicate set of baths for each, one termed "first class" and the other "second class." The gentlemen's baths are on the ground or first story, and those for ladies on the floor above. It is a *sine qua non* in buildings of this class that the entrances for the two sexes should be arranged at distant or perfectly distinct points. This has been effected by placing that for the gentlemen—which is the one most used—on the main front, and that for the ladies in the rear. Waiting, board, and other rooms are provided, and dwelling rooms for the attendants are situated on the upper story.

The swimming baths, which are each provided with springing boards, suspending bars, attendants' boxes, and tiers of numbered dressing boxes on each side, are 100 feet in length and about 45 feet broad, and the entrances and exits are so placed as not to interfere with the approach to the washing baths. The design, for which we are indebted to the *Building News*, is by Messrs. Wilson, Son & Aldwinckle, of London.



Substitute for a Horse.

Chambers's Journal mentions a gentleman who, being prevented by physical disqualification from continuing the exercise on horseback which had always been so beneficial to his health, was possessed with the singular notion that it would be possible to construct a machine which, when seated upon, could be made to evolve the same action as a galloping horse. The inventor made his machine; it answered its purpose to his complete satisfaction; and the device having been patented, it has recently been manufactured and brought before the public. Whimsical as is the purpose of the machine, it has upon trial been commended by many medical authorities, and won no little favor.

The "rider" seats himself upon an ordinary leather saddle, his feet being in fixed stirrups, and his hands grasping a handle attached to a metal projection. The saddle is firmly attached to a small wooden platform below by means of metal connections. This platform is suspended by leather straps from the topmost extremities of four semicircular steel springs, which are firmly attached at the bottom to the metal foundation of the machine. Seated upon the saddle, the operator can be swayed about in all directions.

Beneath the platform are four padded buffers—corresponding to the horse's feet—and by the weight and motion of the operator's body these buffers strike or bump, at each depression, upon the foundation below, so that, with a little practice, an automatic imitation of horse exercise can be produced. The movement can be made either very easy or very violent. By the full use of the handle, a good muscular action is given to the chest and lungs. For invalids and all of a weak bodily constitution, the machine is strongly recommended. It is adjustable for the use of persons of different stature and weight; and for those condemned to sedentary employment, its daily use is said to be attended with beneficial results.

Cheap Method of Heating Factories.

It frequently happens that chimneys are now built round, without corners to retard the draught. This is done by inserting in the chimney, as the building progresses, cores consisting of iron pipes cast in sections, or tile piping. Air spaces are thus left between the core of the chimney and the outer wall, and of course the air in this space becomes heated to a high temperature. It is quite practical to utilize this air for heating purposes, if this is found desirable. The air spaces being closed at the top, and openings being made to the open air at the base of the chimney, tin piping is connected with the spaces for conducting the heat to different parts of the factory. Of course, this method is not designed for heating the stories nearest the ground, as the current of air in ascending has not had sufficient exposure to become heated until it has reached the third or fourth story of the building.

A ST. LOUIS DWELLING.

H. HOHENSCHILD, ARCHITECT, ST. LOUIS, MO.

The illustration herewith presented is that of a frame residence of moderate cost, embracing all modern improvements, and suitable for a city or country residence. The exterior dimensions of the building are 32 feet wide by 48 feet long.

The height of the first floor is 3 feet above the level of the ground, and is reached by wide steps leading to the front veranda, whence a pair of double storm doors open into a vestibule which is made of the proper dimensions to receive a door on each side. The floor of the vestibule is one step lower than that of the main floor, and from it a neat pair of doors, with glass panes, open into the front hall; the latter doors are arranged to swing either inward or outward, so that they can be opened into the vestibule, thus offering abundant space around the sliding doors to the parlor. The hall is square in form, being 15 feet 6 inches.

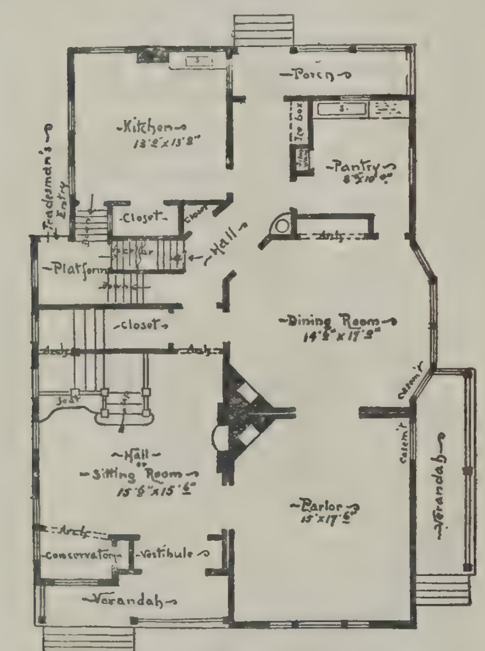
The main stairs are located so as to take up as little space as possible, and yet afford all the room necessary; on the second platform, as shown, a partition separates the upper from the lower flight, and over the opening formed an arch is placed, so that, if desired, it can be draped. Under the stairs is a large closet, which is a convenient receptacle for umbrellas, hats, etc. The front portion of the hall, on a line with the partition of the vestibule, is connected by an arch, and the recess thus formed used for a conservatory, being lighted on the front by a large, and on the side by a mullion window of half size.

The parlor is 15 feet wide and 17 feet 6 inches deep. It is lighted by a triple window on the front, and also by a French window on the side, which open off on the veranda. Sliding doors connect it with the dining room, which is on the octagonal form, having a mullion window in the center and one in each angle. One of these is a French window, opening to the veranda, thus virtually obtaining an entrance to these rooms on this side. A door leading into the rear hall, and a fireplace in the other, occupy the remaining two angles.

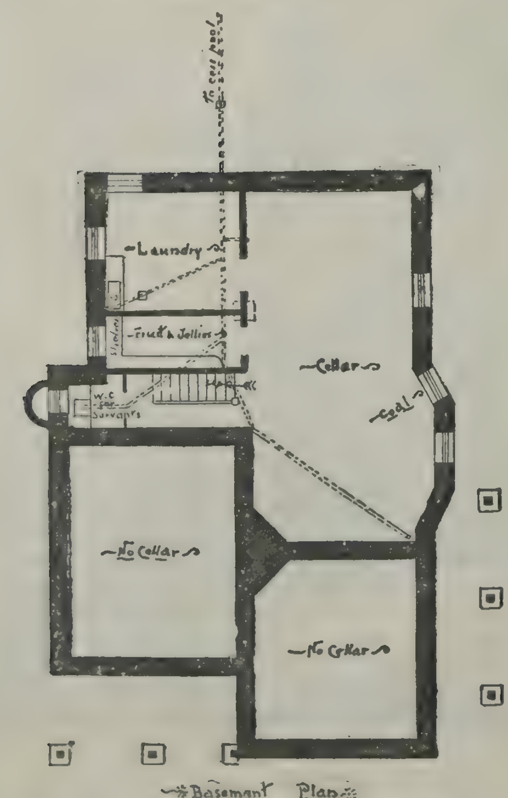
The entrance to the cellar is at the head of the stairs leading to the same, and is lighted by a sash door which receives its light from the window on the platform. The rear hall continues five feet wide to the pantry and kitchen, and has a door at the end opening on to the rear veranda.

Front Elevation

A ST. LOUIS DWELLING.



First Floor Plans



Basement Plan

Basing our figures on St. Louis market prices:

ESTIMATE OF COST OF BUILDING AS ILLUSTRATED.

Excavations	$50 00
Rubble masonry	280 00
Brick work	250 00
Lumber	950 00
Mill work	500 00
Tin and copper work	115 00
Plastering	400 00
Painting	225 00
Plumbing	175 00
Stairs	175 00
Mantels and grates	150 00
Hardware	125 00
Labor	600 00
Total	$3,995 00

—*St. Louis Architect and Builder.*

Simple Way to Measure Land.

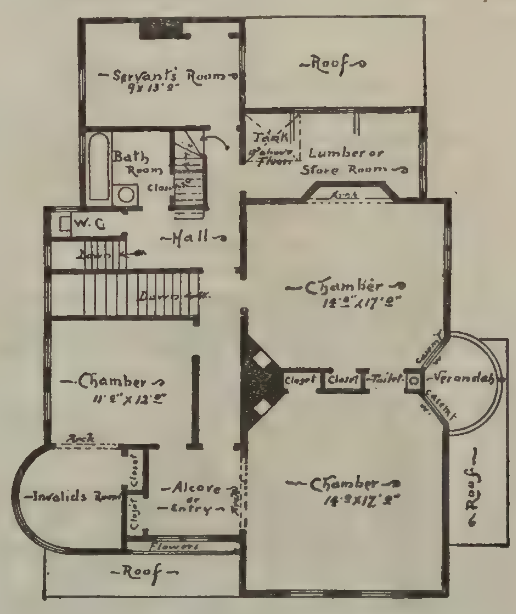
Farmers generally are not aware how easily they may obtain a nearly correct measurement of their square fields and patches of ground. To do this, the first preliminary is to secure an evenly measured step of 30 inches, or rather a full step of 60 inches, or 5 feet. Measure a line of 100 feet in length with a tape line or other accurate measure, and after little practice one can step it so nearly correct as to be surprised. Assume the erect position of a soldier, allow the arms to hang naturally by the side, and then walk at the rate of 2½ miles an hour. At this gait, and in this posture, the foot of a man 5 feet 8 inches high will fall at about 30 inches from the starting point, or the whole step or swing will be 5 feet, thus enabling a close calculation of areas. With a base line of 100 feet to practice on, a soldier soon learns to gauge his steps, and there is no sound reason why a farmer may not educate himself to step distances nearly accurately. I can step 500 feet at times within 12 inches. But accuracy depends on practice and on keeping the body erect. Putting one's hands in his pockets will often make an astonishing discrepancy in a distance of 500 feet. Any carelessness in thought or action has the same effect. In fact, to step with any degree of accuracy requires as close attention to minuteness as measuring with a chain or tape line. A half inch gain or loss on each full step amounts to 20 half inches in 100 feet, there being 20 full length steps of 5 feet each in that distance; and it is quite easy, through carelessness of body or mind, to lose more than a half inch in a step. The acquisition of a measured step has proved a great satisfaction to me, and I rely on it for all my ordinary farm measurements.—*Country Gentleman.*

Restoring of Burnt Cast Steel.

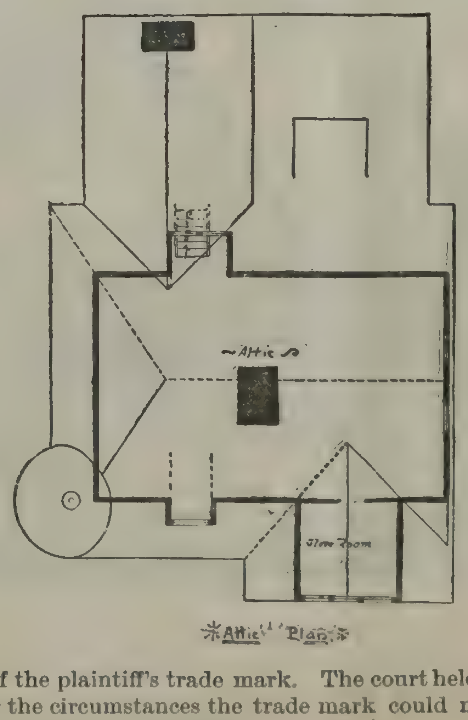
In many machine works, etc., every year a considerable quantity of valuable cast steel, in the form of burnt chisels, knives, etc., hardened by burning, gets lost. A very simple and oft-tried means of restoring in the shortest time the full value and availability to burnt steel, according to a communication of Herr Merlett, works director in Stiahlau, is to melt three parts by weight of pure resin in a crucible, and to add afterward, with slow stirring, two parts of good boiled linseed oil, in which, however, caution is needed, because the mixture at a high temperature easily catches fire. At length, a dark-brown, thick, semi fluid mass is obtained like treacle, which, after cooling, is ready at any time, and can be kept in a covered pot by the forge fire. Each piece of burnt cast steel dipped red hot into this liquid has its former goodness immediately restored. If the treatment be several times successively applied, a fineness is contributed that was not originally present. The hardening is carried out best at a dark red heat and in rain water.

Trade Mark Infringement.

The case of the British Tea Association (Limited) *vs.* Cooke, decided recently by the Chancery Division of the High Court of Justice (England), arose upon an action by the plaintiff to restrain the defendants from infringing the plaintiff's trade mark of "Mandarin" tea. It appeared that the plaintiffs had for some time sold tea in small packages, each package having a label bearing as a trade mark the figure of a mandarin above the words "Imperial Mandarin Tea, imported from China." The defendants afterward sold tea in packages of a different color and appearance under the title "Mandarin Tea," but it was shown that "Mandarin Tea" had been sold in the market before the registration of the plaintiff's trade mark. The court held that under the circumstances the trade mark could not be held to have been infringed.



Second Floor Plan



Attic Plan

RESIDENCE OF JOHN A. RUMSEY.

We give herewith an illustration of the residence of Mr. John A. Rumsey, of Seneca Falls, N. Y., the founder of the well known pump and fire engine works. This is one of the finest mansions in the country. The grounds and surroundings are very attractive. In a future number we hope to give particulars of the dwelling.

Assaying with the Horn Spoon.

BY ELBERT C. VAN BLARCOM.

The sample should first be ground to a fine powder; the finer the grinding, the more accurate will be the result. If there is no mortar at hand, in which to grind the ore, select a flat rock with a surface about 18 inches square, and another smaller rock weighing about 10 pounds, of convenient shape, so that it can be firmly grasped with both hands. Where they can be had, these rocks should be of a hard, silicious character; softer rock may be used, but the grinding will take a longer time. It is not advisable to use as grinding rocks any that contain mineral, as they are liable to enrich the sample.

Place the sample on the large flat rock and reduce it to fragments by a few quick blows from the smaller stone. Now take the smaller stone firmly in both hands and grind the fragments to a powder, grinding a small portion of about one ounce at a time.

Any one who has never tried this method will be surprised at the rapidity with which the grinding is effected. Transfer the sample to the horn, taking care to clean the grinding rocks thoroughly. If the sample contains sulphurets, these will break up more readily than the gangue, and fill up the small cracks and interstices in the grinding rocks. A small stiff brush serves well to clean the grinding rocks.

The sample for assay should not fill the horn to within more than an inch of the rim. Take the horn containing the sample in the right hand, and gently submerge it in a vessel of water, or stream; with the fingers of the left hand thoroughly mix the sample with the water. When the sample has been thoroughly wet, carefully withdraw the horn from the water, bringing the left hand end of the horn out of the water last. During this operation the light, earthy particles contained in the sample will rise to the top, and as the horn is withdrawn from the water they will flow off. This operation should be repeated two or three times, until nothing but the clean sand remains in the horn.

When the light matter has all been removed, take the horn (having the sample covered with about half an inch of water) in the right hand, letting the weight bear on the third finger and balancing it with the thumb. After mixing the contents of the horn thoroughly with the fingers of the left hand, oscillate the horn in a right and left direction, at the same time giving it a slight up and down (a sort of shivering) motion with the third finger of the right hand. During this operation the left hand end of the horn may be supported on the fingers of the left hand; the motion should all come from the right hand, the left hand simply serving as a support. By continuing this motion a few moments, gravity will take the mineral particles to the bottom, while the lighter particles of gangue will remain on top. The sample should now be brought to the left hand end of the horn, inclining the horn slightly to the left; allow the water to run off, after which remove with the left hand the upper portion of the sample, from which the minerals will all have become separated.

The concentrating and removing of the barren particles should be continued until the amount of mineral can easily be seen. From the amount of mineral left, after concentrating, one can readily judge the approximate value of the ore.

A "horn" may be made by sawing in two, obliquely, any good sized cow's horn. This will give an elliptical shaped vessel, about 2½ inches deep, flaring off at either end.

Where the available horns are small, select the straightest one, split it lengthwise *on the inside of the curve*, lay it in hot ashes, and when it is thoroughly heated it can be moulded into the desired shape.

To make one's self an expert in this method of assaying, one should have fire assays of the sample made; knowing the fire assay and observing the yield from a given amount of ore, one will soon be able to judge very closely the values of ores.

In Mexico the horn is used almost exclusively, even as a test for value when the ore is to be purchased. Of our own knowledge we can say that we have known the assay by the horn, given us by a Mexican, to have been within one dollar of the same sample afterward assayed by the fire method.—*Min. and Sci. Press.*

To boil a cigar holder to clean it out, use alcohol. Care must be taken to prevent its coming in contact with the outside of the meerschaum.

New 110 Ton Gun.

The Eider lately arrived at the Royal Arsenal, Woolwich, from Sir William Armstrong's factory at Elswick, Northumberland, with the new 110 ton gun, the largest piece of ordnance yet manufactured in England. The new weapon is 44 feet in length and 16¼ inches in diameter, the actual weight being 247,795 lb. The proof carriage, which at present weighs 92 tons, and is 21 feet in length, is almost entirely constructed of cast steel, and is adapted for three sizes of guns, the pistons being given a lateral motion to make it suitable for this purpose. The gun carriage is mounted on three sets of bogies of four wheels each, for traveling to and for use at the proof butts. It is also fitted with racers for further testing purposes at Shoeburyness, where it will be mounted in a battery. The gun, which is without trunnions, as all large naval guns are, will have a trunnion box, which will add eleven tons to its weight, so that the gun and carriage, when ready for proof, will not weigh less than 220 tons, as there are several additions to be made to the carriage by way of derricks, etc. The gun is at present fitted with a breech screw worked by hydraulic machinery, for use on board H.M.S. Benbow; but as there are no hydraulic appliances at the Woolwich proof butts or at Shoeburyness, it has been found necessary to have a breech screw worked by hand for the purpose of proof and trial. H.M.S. Benbow is to be armed by four of these formidable weapons, and she will then be the most powerful vessel afloat.

Lining Cameras with Velvet.

If the interiors of many cameras were lined with black velvet or similar material, much more brilliant negatives might be obtained, particularly when working with plates of exalted sensitiveness. The inside of cameras which are in constant use, as they are in the studio, by continual dusting in time become to an extent polished, or sufficiently so to reflect a certain amount of light. Feeble as this light may be, it is often strong enough to have an effect on an exceedingly sensitive film, and to veil the shadows, and so destroy much of the brilliancy of the negative. We happen to know of an instance where some extremely sensitive plates were condemned on this account, or would have been, had not two cameras been in use at the time; and it chanced to be noticed that the negatives taken in one camera were far more brilliant than those obtained in the other, which was new—*Br. Journal.*

RESIDENCE OF JOHN A. RUMSEY, SENECA FALLS, N. Y.

A DESIGN FOR A COTTAGE.

The illustration shows a plan by Edw. Hurst Brown, of 1430 South Penn Street, Philadelphia, for a two story frame suburban cottage to cost about $4,500. It shows a first story clapboarded, the second story and roof of shingles stained with warm creosote colors, with the gables in rough cast plaster. The floor plans show the interior arrangement with the exception of the attic, where is the girl's room.—*Sanitary News.*

Regulations of House Drainage and Plumbing in Denver, Col.

The City Council of Denver, Col., has passed an ordinance regulating the practice of plumbing and prescribing the manner in which work shall be accomplished. The ordinance was drawn by H. C. Lowrie, city engineer, and is as follows:

SECTION 1. Before the building inspector shall issue to any person or persons a permit to construct, reconstruct, or in any way alter any building in the city of Denver, such person or persons shall first submit to the city engineer a plan of the proposed drainage of such building, together with a clear description of the plumbing proposed to be connected to such drainage, on a blank to be prescribed and supplied for such purpose, showing the size, kind, and weight of pipes, and the kind of trap, closets, and fixtures to be used, which shall be for examination and retention on file.

SEC. 2. All drawings must be made legibly to scale, in India ink, on vellum, in sheets eight by twelve and one-half inches, with an inch clear margin all around drawings. Where practicable to show all the work plainly, but one sheet, showing one vertical section of the house and drainage plan, shall be used.

SEC. 3 The city engineer shall examine the plan of such proposed system, and approve or reject the same as promptly as practicable and within ten days from the date of filing. In case of approval of such plan, the city engineer shall issue a certificate to that effect, without the receipt of which certificate the building inspector shall not issue any building permit therefor.

SEC. 4. After a plan has once been approved, no alterations of the same will be allowed, except on the written application of the owner of the proposed building, and a proper compliance with the regulations respecting the same. In the case of rejections, the city engineer will note on the drawing his objections thereto, and shall retain the same, and shall promptly reply to all requests in writing for information as to rulings, etc.

SEC. 5. Upon the approval of any plan of house drainage, as aforesaid, the building inspector shall, upon application duly made, issue to any registered plumber of the city of Denver a permit to do the plumbing therein, according to the plan thereof, duly approved.

SEC. 6. No person or persons shall carry on the business of plumbing in the city of Denver unless there shall have been first registered in the office of the city engineer the name, style, and street location under which such business is done.

SEC. 7. Every plumber, before doing any work in a building in connection with the drainage system thereof, shall, except in the repair of leaks, apply to the city engineer, upon proper blanks to be provided, containing a full description of the same, and shall do no such work without such permit and the inspection and approval of the engineer.

SEC. 8. The following general rules shall govern the inspection of drawings and work for which permits may be issued or sought to be issued:

Rule 1. The house drain, when laid beneath the ground or cellar floor, shall be of hard, salt-glazed, cylindrical earthenware pipe, of not less than four nor more than six inches in diameter, laid on a smooth bottom, with the foundation well and evenly rammed to prevent settling. Each section of pipe must be wetted before applying the cement, and joints must be carefully and completely filled with the best hydraulic cement mortar, freshly made and mixed. An interior straight edge must be used, the interior of all joints must be struck, and the whole interior of the drain must be left smooth, clean, and uniform, and on a grade of not less than one foot in one hundred. There shall be as few changes in alignment as possible, and those only in easy curves. No right angle turns shall ever be made, either horizontally or vertically. No such drain shall be covered until it shall have been examined while it is full of water, and duly approved by the city engineer, or his duly appointed agent or inspector of plumbing, who shall be entitled to at least eighteen hours' written notice, at his office, of the time at which examination is desired.

Rule 2. Soil pipes or air pipes connected with the drainage system shall be of iron; no brick, sheet metal, earthenware or chimney flue shall ever be used; they shall be sound, free from defects, of a thickness nowhere less than one-eighth of an inch for a diameter of four inches or less, or five thirty-seconds of an inch in thickness for a diameter of five inches, beyond which latter none shall be used. Soil pipes shall be securely ironed to walls or suspended to floor timbers by strong iron hangers, as the engineer or his duly appointed agent or inspector of plumbing shall direct, shall have a fall toward the sewer in all places equal to one-half inch in one foot, shall be carried out through the roof open and undiminished in size to such height, not less than two feet above the roof, as may be approved by the engineer or his duly appointed agent or inspector of plumbing. Changes in direction shall be made with curved pipes, and connections be made with "Y" branches.

Rule 3. Iron pipes, before being put in place, shall be first tested to stand a pressure equal at least to ten pounds per square inch, and then shall be coated inside and out with coal tar pitch, applied hot to the heated pipe, or with paint. Joints shall be run with molten lead, thoroughly calked and made tight. Connections of lead pipes with iron pipes shall be made with brass ferrules; the lead pipe shall be properly soldered to the ferrule, which shall be thoroughly calked into the hub of a branch of the iron pipe.

Rule 4. Rain water leaders shall not be connected with the sewer system except when expressly authorized in writing by the board of health and the city engineer.

Rule 5. The earthenware drain beneath any basement or cellar floor must be trapped just within the foundation wall with a running trap of the same size and material as the sewer pipe, with a suitable hand hole accessible for cleaning. No connection shall be made between this trap and the sewer, excepting a branch from a grease trap and a ventilating pipe, as provided for by ordinance in relation to drains. In lieu of such running trap in the drain, however, there may be placed at the foot of the vertical soil pipe, or near the foot, any suitable flushing trap approved by the board of health. There must be a fresh air pipe of three inches diameter running from the drain or soil pipe above either the drain trap or the soil pipe trap, and not more than ten feet from it, to the outer air, and opening at any convenient place, away from any door or window, if so required.

Rule 6. Every wash basin, bath tub, sink, urinal, water closet, or other fixture connected with drainage pipes shall be separately trapped as close to the fixture as possible, and never more than two feet away. Water sealing traps of any pattern may be used when separate air pipe connections from the same are provided, of a size not less than the waste pipe, and preventing siphonage or air pressure. Where separate air pipes are not used, traps approved by the board of health as traps which will not unseal by siphonage or air pressure must be used. All connections of lead shall be made with solder joints. All waste pipes must be provided with strong metallic strainers.

Rule 7. Air pipes must not terminate in or be led through chimney flues. They must be carried up inside the house. When more water closets than one discharge into the same vertical line of soil pipe, a separate air connection, not less than two inches in diameter, must be provided for the trap of each closet, which pipe may connect with the soil pipe above the upper closet. When the trap of the water closet is set two feet or more from the vertical line of the soil pipe, a return connection must be in all cases provided, even when there is but one closet on the line. Air pipes from several traps may be combined by being joined and then carried into a soil pipe above the inlet from the highest fixture, or continued above the roof. The material, work, and tests for air pipes shall be the same as those prescribed for soil and waste pipes of like size, and all must be strictly first class.

Rule 8. No overflow connection shall be made with any part of a trap except into the inlet pipe thereof, above the seal. No bath tub waste shall ever be connected to any water closet trap; it shall be separately trapped and led into the soil pipe below such water closet trap; if adjoining, and in general, no connection of any waste pipe other than the one from the fixture trapped shall ever be made to any trap.

Rule 9. Drip or overflow pipes from safes under water closets and other fixtures, or from tanks or cisterns, shall in no case be connected directly to the drainage system, but shall be run to some place in open sight.

Rule 10. Waste pipes from refrigerators or other receptacles in which provisions are stored shall not be connected directly with the drainage system, but shall be arranged to waste into an open tray, in plain sight below the refrigerator. This tray may be connected with the drainage pipes upon being properly trapped like any other fixture.

Rule 11. Every water closet or group of water closets on the same floor above the first floor shall be supplied with water from a separate tank or cistern, the flushing pipe shall be never less than one inch in diameter, and closets above the first floor of any building must never be supplied directly from the pipes of the water company.

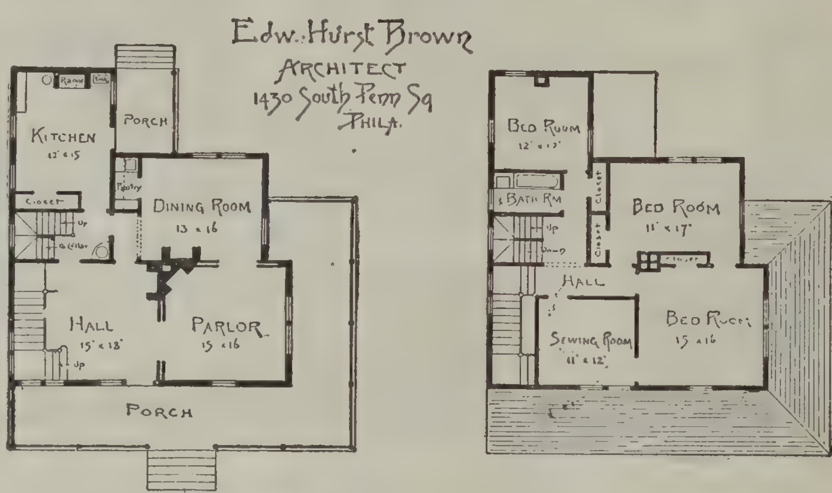
Rule 12. Pipes and fixtures shall not be concealed from view until after examination and approval by the city engineer or his duly appointed agent or inspector of plumbing, and he shall be entitled to eighteen hours' written notice from the plumber of the time inspection is desired. The city engineer shall record in his office the results of all examinations.

Rule 13. Plumbing work shall not be used until the same has first been tested by said engineer with the peppermint, ether, or water test, and has been by him approved.

Rule 14. A grease trap shall be constructed under the kitchen sink of every hotel, restaurant, or other public cooking establishment, and between every dwelling house and the sewer on a separate branch to the kitchen thereof.

SEC. 9. Under the written application of any citizen, the board of health shall consider, at its next meeting thereafter, and decide upon any appeal from any decision of the city engineer, under the provisions of this ordinance. The board of health shall likewise test and approve or disapprove of any drainage trap presented, for which it is claimed that it will not unseal by siphonage, or by air pressure from the outlet thereof.

SEC. 10. Any owner, agent, architect, plumber, superintendent, contractor, or other person failing, neglecting, or refusing to comply with any of the provisions, terms, or requirements of this ordinance shall, upon conviction thereof, be fined in any sum not less than five dollars nor more than fifty dollars for the offense, and at the rate of twenty dollars per day or part of a day of continuance of such violation, after due notice from the building inspector to remedy the same.



DESIGN FOR A COTTAGE.

SEC. 11. It is hereby made the duty of the building inspector to secure the proper enforcement of this ordinance, and to promptly investigate any information he may receive of its violation, and to promptly proceed in complaint and prosecution in any case of its violation of which he may have knowledge, or due and reliable information.

DYNAMO BELTING IN ITS RELATION TO ELECTRICITY.

One of the most essential factors in the proper running of electric dynamos is a suitable belt. It has been found in practice that ordinary belting is not adapted to this use. Nor is this strange, for it has also been found that engines made with special reference to this kind of work are the only suitable motors for the business. Since the belt runs at a very high rate of speed, and over a very small pulley, the belt should possess at least the following peculiarities :

If it be a single belt, it should be very heavy. The leather should be made from the very choicest young steer hides, taken from fat creatures, so that all the fibers shall be strong, and the leather shall be rich in gelatine Only a small portion of each hide should be taken for this purpose. It is, however, far better to use a double belt, provided it is suitably fastened, so as not to come apart, because one of the most essential qualities demanded is that the belt should be perfectly balanced ; that is, each foot of its length should weigh the same as every other foot, and this can be more surely done in a double than in a single belt. But if the belt is double, it should not be very heavy. It should, however, be made out of the same quality of stock as before mentioned. The belt should be dressed with some preparation which will render it substantially proof against atmospheric changes. It should then be fastened at the laps, and, if double, along the edges as well, by some special means which will secure it against risk of starting apart on the edges as it goes over the pulley, which is usually very crowning in the center. Such a belt as we have described is made by the Page Belting Company, of Concord, N. H., whose long experience in the business and excellent facilities enable them to produce an article that exactly meets the wants of all who run electric dynamos. They have given to this quality of belt the very appropriate name of "Dynamo." It is made from just such stock as we have described, and every belt is thoroughly tested after being made before it is sent out. It is treated with their "Banner Leather Dressing," which makes the belt waterproof, and adds in every way to its value, without in any wise injuring the belt, as so many preparations are apt to do. It is fastened along the edge, if it be double, once in ¾ inch, and if it be single, once in ½ inch, by means of copper wire sewing, which is a square piece of wire, pointed at both ends, very sharp, and thoroughly clinched on both sides of the belt, making a sort of letter C. as shown in the accompanying cuts.

SECTION OF WIRE SEWED DOUBLE BELTING.

SECTION (ON REDUCED SCALE) OF WIRE SEWED SINGLE BELTING.

This clinching process is so well done that the surface of the belt is left perfectly smooth; and, as will be seen, it possesses this advantage over pegs and cable screws, that, by clinching in the form shown, it is a thoroughly secure fastener. It also has the advantage over either wax thread or lace-sewed belts, since neither of these will leave the surface of the belt perfectly smooth.

It is needless to say that copper rivets should never be used in a dynamo belt, because they present a large metal surface to come in contact with the pulleys; nor can they practically be put near enough together to secure the edges, as is accomplished by this wire sewing.

ORNAMENTAL IRON RAILING.

This useful little design for an iron railing is intended to be carried out in either cast iron or zinc, the light scrollwork in the lower portion being of flat bar wrought iron, giving the whole railing somewhat the character of wrought-iron work. The posts are intended to be about 4 feet 6 inches high, and the other work in proportion. The design, which has been sent to us by Mr. Edward C. Magnus, of Crefeld, Germany, would prove a very serviceable one in execution.

DESIGN FOR AN ORNAMENTAL IRON RAILING.—BY ED. C. MAGNUS.

Combat between Whale, Swordfish, and Thrasher.

When the British steamship Humboldt was off San Salvador, Brazil, the attention of her officers and crew was attracted, on the morning of June 10, by a furious commotion of the waters a short distance ahead. As the vessel neared the spot, it became evident that a terrible combat was in progress between monsters of the deep. The sea was lashed into a perfect foam. Within a circumference of a hundred feet the waters fairly boiled, while numerous whitecaps floated away beyond this circle. The steamer was brought to within a short distance of the scene of the struggle, and then stopped in order that its further progress might be watched. A swordfish and a thrasher had made common cause against a tremendous sperm whale, and the battle waged furiously. Strength and size were with the whale, and swinging around as if on a swivel, the huge tail was used with prodigious power. The animal would raise itself aloft, almost out of the water, and blowing the spray through its nostrils, would make frantic efforts to annihilate its foes. But dexterity and skill were on the other side, and proved more than a match for mere strength and bulk. The tactics adopted by the assailants showed a remarkable harmony of purpose. The thrasher is supplied with a "sucker," enabling it to stick to whatever it attacks. Springing upon the back of the whale, it had little difficulty in maintaining its hold, while it lashed the unfortunate monster with its tail, actually whipping it to death. It kept up its own mode of attack, while the swordfish drove his sword time and again into the side of their huge antagonist. The sea was dyed crimson with the blood of the whale. After a vigorous resistance, it was forced to succumb to the combined beating and stabbing, and floated upon the sea, a lifeless mass.

An Enormous Granite Slab.

To separate from the main ledge a slab of granite 354 feet long, 3 to 4 feet thick, and 11 feet wide, is no ordinary feat to accomplish.

But this has been done at the Flynt Granite quarry, in Monson, Mass., and by the means usual in all quarries for separating slabs or blocks from the main ledge. A row of wedges were set, several hundred in number and the workmen, beginning at one end, gently and carefully tapped the wedges, moving by degrees down the line, until the other end of them was reached, when the same operation was repeated.

In this manner, by careful and patient application, aided by favorable conditions of the weather, the slab of the above phenomenal size was successfully separated from the main rock.

The value of this immense slab, if it could have been transferred safely to one of our large cities at not too great cost, would have been several thousand dollars. And it seemed almost sacreligious that it was necessary to cut it up into smaller blocks for transportation and finally used for ordinary building purposes. The possibility of getting out a slab of such size without breaking it indicates that the grain of the Monson granite not only runs evenly, but that it possesses great tenacity.

Best Mode of Ventilation.

Speaking upon the subject of the ventilation of dwelling houses, before the Toronto Sanitary Association, Mr. David Dick controverted the theory that the carbonic acid of an inhabited room can be drawn off by outlets placed at the floor level, which is the French practice. He pointed out that, in view of the principle of the diffusion of gases, it is impossible to expect that carbonic acid, although the heavier gas, will so far separate itself from the other components of the atmosphere as to be susceptible of withdrawal at a low level. According to Mr. Dick, the only factor to be regarded in ventilation is temperature. The air is cold at the floor line and warm at the ceiling, the difference in rooms artificially heated or full of people being seldom less than 20 deg. Fah. Owing to this tendency of heated air to rise, and to be supplanted at the floor line by cold air coming in from crevices in the doors and windows, etc., Mr. Dick considers that a room cannot be properly warmed solely by the radiant heat of a fire. The heat from this source should be helped by some means for preventing the draughts of cold air on the floor. With this view, Mr. Dick advises that rooms should be provided with many inlets for warmed fresh air at the floor line, the effect of which would be to drive up all impure air toward the hotter stratum near the ceiling.

An outlet at the ceiling line would then carry off the whole of the vitiated air. As the warm air begins to rise as soon as it enters the room, the more it is subdivided into separate inlets the better, because it will ascend by the most direct line to the outlet; and, therefore, a number of small streams will move the general body of air in the room more effectually than one large current, which would be likely to pass through the body of air without affecting anything that did not happen to be directly in its path.

The temperature of the inflowing air should be moderate, and its velocity low. It is desirable, however, that there should be only one outlet for foul air from an apartment, because if there were more than one the draught might be unequal, and then one would pull against another, causing a flow of air down one and up the other, instead of from the proper inlets. Of course, the one outlet need not appear as such in the apartment, as its mouth may be concealed by a perforated cornice or other device.

New Alloy of Aluminum.

The applications of aluminum are now considerable, and M. Bourbouze, a French physicist, has added to their number by employing an alloy of the metal with tin for the internal parts of optical instruments, in place of brass. The alloy he employs consists of ten parts of tin and 100 parts of aluminum. It is white like aluminum, and has a density of 2·85, which is a little higher than that of pure aluminum. It is therefore comparatively light, which is an advantage for apparatus where lightness is desired. It can be soldered as easily as brass, without special means, and it is even more unalterable than aluminum to reagents. The attention of electrical instrument makers should, therefore, be called to it, especially for apparatus of a portable character.

A Curious Life Preserver.

An English physician, Dr. Sylvester, has proposed a singular way of preventing death by drowning, as, for example, in case of a shipwreck. He suggests inflation by means of a hypodermic opening in the neck or back of the cellular tissue, with a certain quantity of air; the emphysema or air tumor thus produced will act as a life preserver.

In urgent cases, he proposes incision of the gum with a penknife near a molar tooth, then to expel air strongly from the lungs, keeping the mouth and nose closed. In this way an air tumor is quickly produced that will keep the head above water. The process seems decidedly open to criticism, but is so singular and original as to deserve notice.—*Revue Scientifique.*

PYGMY CATTLE.

The extraordinary pygmy cattle of Benares and other parts of India, a specimen of which, about the size of a month old calf, has for some time been on exhibition at Central Park, are the result of careful selection continued for many generations, and are very fair representatives of the result of heredity. A cow of the same diminutive variety was for years an attraction to visitors at Prospect Park, Brooklyn.

The disposition of these small cattle, as indicated by their expression, is extremely mild and gentle. In their own country they are, as indicated by their name, worshiped by the natives as incarnations of the Holy Spirit and as containing the soul of some future Buddha. Treated with the greatest consideration and never subject to the vicissitudes that the Bos genus is subject to in Christian countries, they may rather be said to own their keepers, who are their servants, and who would consider it a greater crime to harm one of them than to kill a human being. Ramsay Wright considers the humpback cattle of India possible descendants of the gayal or gam, the wild cattle of Bengal and the peninsula generally. The method of catching and domesticating these cattle by the Kookies of the Chittagong hill districts is as follows:

A number of balls, each about a foot in diameter, composed of salt, cotton, and a particular kind of earth, are first made up and scattered about a part of the jungles frequented by the animals. A number of tame cattle are then driven to these places, where they await the coming of the wild ones. The two herds mingle, the opposite sexes associating together. As they graze, the balls, attracting attention by their shape and smell, are tasted, and relishing the taste of the salt and the earth of which they are composed, the combined herd of tame and wild cattle never quit the spot until all the balls are consumed.

"The Kookies," says Mr. Macrae, from whom this account is quoted, "having once observed the gayals to have tasted the balls, prepare a sufficient supply of them to answer the purpose, and as the gayals lick them up they throw down more. It is to prevent them from being too readily consumed that the cotton is mixed with the earth and salt. This process generally goes on for three changes of the moon, or for a month and a half, during which time the tame and wild cattle are always together, licking the decoy balls; and the Kookie, after the first day or two of the mingling of the herds, makes his appearance at a distance, so as not to alarm the wild ones. By degrees he approaches nearer and nearer, and at length the sight of him has become so familiar that he can advance to stroke the tame cattle on the back without frightening the wild ones. He next extends his hand to the latter and caresses them also, at the same time giving them plenty of decoy balls to lick. Thus in the short space of time mentioned he is able to drive them along with the tame ones to his "parrah," or native village, without the least exertion of force; and so attached do these captives become to the parrah that, when the Kookies migrate from one place to another, they always find it necessary to set fire to the huts they are about to abandon, lest the gayal should return to them from their new pasture grounds.

The small variety shown in our illustration is sometimes kept as a garden pet in our own country.

PYGMY OXEN AT THE CENTRAL PARK, NEW YORK.

The Air of the Sea.

The air of the sea, taken at a great distance from land, or even on the shore and in ports when the wind blows from the open, is in an almost perfect state of purity. Near continents the land winds drive before them an atmosphere always impure, but at 100 kilometers from the coasts this impurity has disappeared. The sea rapidly purifies the pestilential atmosphere of continents; hence every expanse of water of a certain breadth becomes an absolute obstacle to the propagation of epidemics. Marine atmospheres driven upon land purify sensibly the air of the regions which they traverse; this purification can be recognized as far as Paris.

The sea is the tomb of moulds and of aerial schizophytes.—*MM. Moreau and Miquel.*

Fish Killed by Poisonous Water.

Large shoals of dead fish have been met with between Egmont Key Light and Charlotte Harbor, off the mainland, and vessels have been several hours in passing through them. A few weeks ago the fishing schooner City of Havana, Captain John Curry, lost two loads of live fish, which were killed in sailing through strips of this poisoned water. It is said to be of a reddish color, and distinguishable for some distance from the surrounding water. Captain Samuel Morgan, a patient in the hospital, informs me that in some of the fresh water creeks fish are caught by placing bags of the bruised bark of the swamp dogwood (*Cornus sericea*) in still water, and that the fish will revive if allowed to remain in it for a short time only. There would appear to be some connection in this, as the mortality seems to appear after considerable rainfall in the swamps and fresh water outlets, and is not due, as has been stated, to submarine volcanic action. I have mentioned the fact to Dr. Joseph Y. Porter, U. S. A., and requested him to take advantage of his proposed visit to Tampa, Fla., this week, to collect samples of the water, should the vessel pass through any of these reddish colored strips.—*A. H. Glennan, Bulletin Fish Com.*

Pigments under Natural and Artificial Light.

M. Petrouschewsky has communicated to the *Journal* of the Russian Physico-Chemical Society an account of some experiments undertaken by himself for the purpose of ascertaining what mixtures of colors will give in sunlight the same effect upon the eye that is produced by various known colors as viewed by artificial light. A special form of photometer was used in these experiments, in which one-half of the field of vision is occupied by the piece of colored paper illuminated by the artificial light, while the other half is taken up by a card placed upon the table and exposed to daylight. Upon the surface of this card the colors are mixed until the general effect equals the tint of the other, and the two halves of the screen appear of the same color. Thus, to give to white paper the appearance which it has under the rays of a petroleum lamp, it is necessary to color it orange, or yellowish orange if the petroleum light is very bright. Papers colored reddish orange and vermilion become so intense in lamplight that it is impossible to imitate them by means of oil colors. Violet pigments take the aspect of reddish brown, not in the least resembling the true color. The mixtures of pigments thus obtained, looked at apart from the light of the sun, are very far from producing to the eye the same sensations as with the light of a lamp. In fact, the sensitiveness of the eye for various colors of the spectrum changes when this organ is accustomed to the yellowish light of petroleum, and the effect of the contrast with orange, which under this condition is taken for white, is an additional cause of error of judgment. By modifying his apparatus, the author has been able to continue his experiments under the electric arc light, which appears yellow in comparison with the light of the sun, and not bluish, as is generally thought.

Our Native Birds.

We are glad to see that the movement for the protection of American birds, recently started by the Ornithologists' Union, has been very generally taken up by both the daily and weekly press. It is only in this way that a public sentiment can be created against the present indiscriminate slaughter of birds, which characterizes every part of the country where the birds and man come in contact with each other. The classes to whom this appeal for the life of the innocent songsters must be made are so widely different that probably on no other issue could they be named in the same connection. It is odd that the first and strongest appeal must be made to those whom we would suppose to be the natural defenders of the birds, the women of the country.

Yet so remorseless has been the war which the gentler sex has indirectly waged against these feathered visitors, that it has acquired the unenviable title of belonging to the "dead-bird wearing gender." It is estimated that five million birds are annually sacrificed for the personal decoration of the women of the United States. If every woman who contemplates decorating her next bonnet with stifled songsters would reflect that with thousands of others indulging in the same barbarous fancy, there will soon be no birds left to gratify either personal vanity or the better love of bird companionship before they have been rendered mute and lifeless, we think it would be easy to persuade her to substitute some more fitting decoration. Other causes are also helping to depopulate our groves and forests. Many birds which do not secure protection under the game laws now existing in nearly every State are being killed for food, and each year the list is extended. Our markets are already stocked with such great variety that there seems absolutely no excuse for this slaughter.

Not only are the adult birds destroyed, but the eggs are consumed in large quantities. And then there is the traditional small boy, whose instinct is to kill, if we are to believe what we are told —but there is another side to his nature. If his sympathies are once enlisted, he is a most loyal champion, and will do good battle in the cause to which he devotes himself. If the bird protection societies can win over this impetuous little advocate, they will lose a very destructive enemy and gain a very active friend.

Though the list of bird destroyers is by no means exhausted, we have space only to refer to one other class, those who collect for scientific purposes. This is perfectly legitimate, and requires a much less number of birds than is usually accredited to it. In all the museums of the country, both public and private, there cannot be more than half a million birds—onetenth the number annually demanded by fashion. There are also egg collectors, whose apparent cruelty in robbing the nest of its treasured contents is entirely justified by the strictly scientific use to which the eggs are put. But there are just now numbers of pseudo-scientists all over the country, who are influenced simply by the prevalent mania for collecting anything and everything, without regard to their ability to make it valuable. These people kill birds by the score, and steal eggs by the dozen, and make a collection, but the absence of classification or an attempt at completeness prevents it from having any value whatever.

So many reasons conspire to make a plentiful bird life desirable, that the question of why we should protect it seems to answer itself. For purely utilitarian reasons, as a check upon the insects harmful to vegetation, the birds deserve our protection. Even those birds which have themselves a bad reputation as garden marauders destroy more insect enemies than garden products. Not one can be shown to be wholly injurious.

And as a pleasing and beautiful form of natural life, nothing surpasses the sociable little house birds or the wilder dwellers in the woods. To have broad meadows and country lanes devoid of the cheerful song of birds and noisy only with the monotonous whir and buzz of insect life, would be to rob them of one of their greatest charms.

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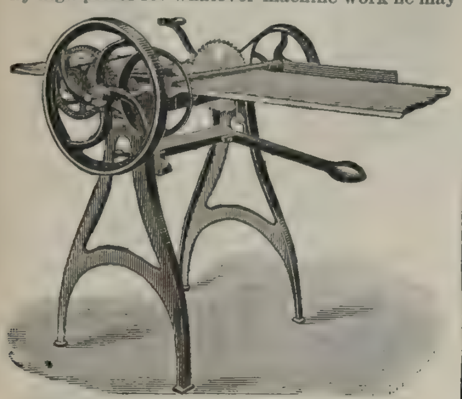

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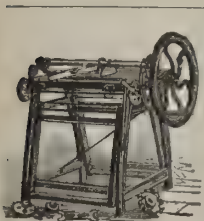

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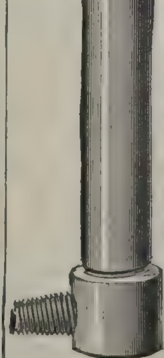

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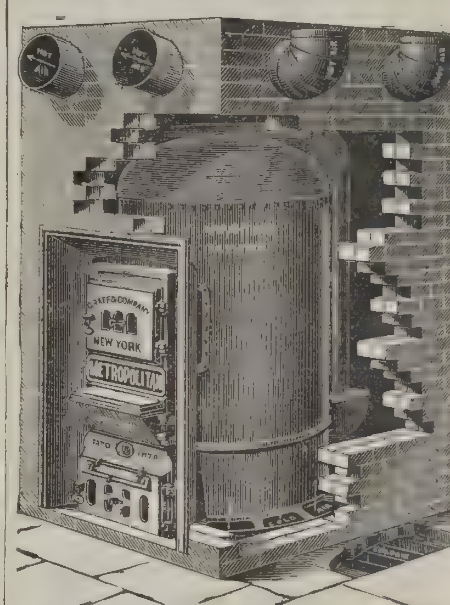

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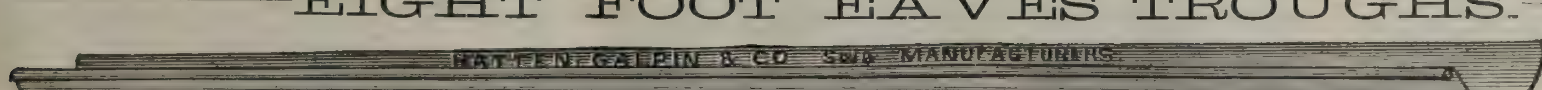

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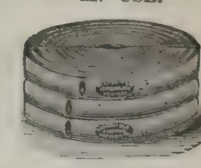

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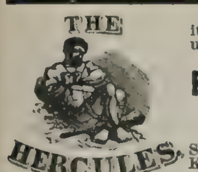

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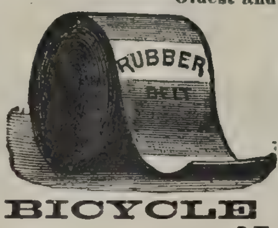

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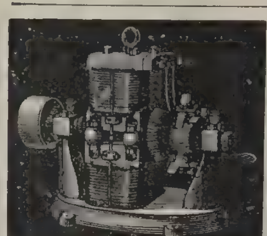

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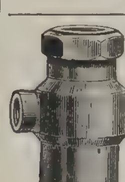

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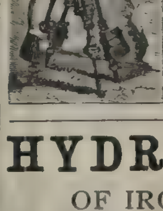

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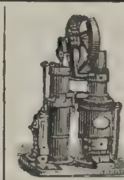

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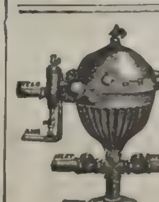

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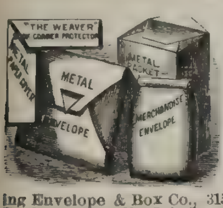

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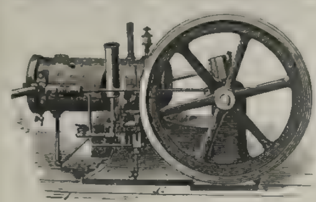

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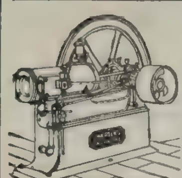

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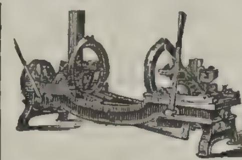

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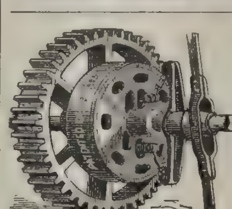

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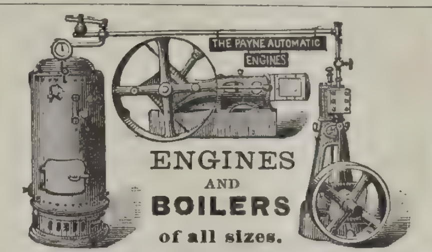

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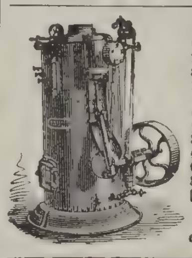

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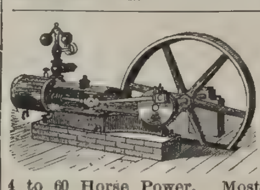

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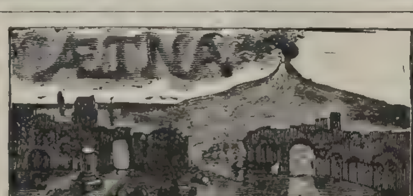

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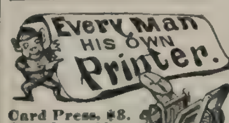

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) A. C. R. writes: 1. Can you recommend me a good rubber cement? I wish to cement leather together, the cement to be waterproof, to resist oil, and the leather to retain its elasticity after pressing. A. Dissolve gutta percha in bisulphide of carbon; shave off the edges of the leather, and pour on the cement; allow to evaporate to dryness. Then put the two faces together, previously heating thoroughly, and press until cool.

(2) F. E. S. asks how to make amber varnish to varnish violins. A. Take of amber 3 ounces, benzol 50 ounces; heat the amber in a closed vessel to a temperature of 570° Fah. When it begins to soften and swell, giving off white fumes, then dissolve in benzol; amber is also soluble in chloroform. The gum may be purchased from any dealer in gums in New York or other large cities.

(3) J. E. W.—We know of nothing that can be added to shellac to increase its adhesiveness. It does not have any odor by itself. In the manufacture of shellac varnish, the gum should be dissolved in ethyl alcohol, but frequently methyl alcohol is substituted on account of its cheapness, although it has an exceedingly disagreeable odor.

(4) W. J. M. asks how papier mache is made to stand the action of water. A. Coat with a mixture made by fusing together equal parts of pitch and gutta percha, to which is added two parts of linseed oil containing five parts of litharge. Continue the heat until the ingredients are uniformly commingled, and apply warm.

(5) J. D. H. desires a recipe for the manufacture of a white ink that can be used in a ruling pen as India ink is used. A. Mix Chinese white with water containing enough gum arabic to prevent the immediate settling of the substance. Magnesium carbonate may be used in a similar way. They must be reduced to impalpable powder.

(6) J. W. O. writes: 1. I have some gold coin dissolved in aqua regia; how can I recover it so I can sell it? A. The gold may be precipitated by means of iron sulphate. 2. Will you give a recipe for making phosphorescent paint? A. See "How to Make Luminous Paint," in Scientific American Supplement, No. 249. 3. Also one for making inks that will fade out in four, six, or eight weeks. A. See the article on "Inks," in Scientific American Supplement, No. 157. 4. What is the specific gravity of gold and silver coin? A. The specific gravity of gold is 19·50, that of silver 10·50, and that of copper, which is an alloy of silver coin, 8·788.

(7) M. E. R.—There are a variety of well pumps to be had through the hardware trade. We know of nothing better than oak for a chain pump box. Your tile drain should not be tolerated near a well. If the drain is necessary in its present position, it should be made of cast iron pipe with lead joints well tamped. There is no simple test for contamination in wells. Poisonous water often looks bright and clear.

(8) J. S. W. asks as to the use of a spray of water for reducing the temperature of a room. A. It may be done by a spray fountain or a spray jet thrown against a muslin curtain. Any means to produce a large evaporating surface supplied with water (cold if possible) will acomplish your purpose.

(9) W. S. desires a recipe for making a cheap varnish for varnishing furniture. A. The following is a fine, lustrous polish for furniture: Half pint linseed oil, half pint old ale, the white of an egg, one ounce spirits of wine, one ounce spirits of salts. Shake well before using. A little to be applied to face of soft linen pad and lightly rubbed for a minute or two over the article to be restored, which should be first rubbed off with an old silk handkerchief. It will keep any length of time if well corked.

(10) R. W. W. desires a receipt to make a good water stain to imitate walnut, not to cost too much. A. Take of burnt umber 2 parts, rose pink 1 part, glue 1 part, water sufficient; heat altogether and dissolve completely. Apply to the work first with a sponge, then go over it with a brush, and varnish over with shellac.

(11) G. W. H. asks the composition of a fusee, or large scented match, which when ignited perfumes the air around? A. Dissolve $\frac{3}{4}$ ounce niter in $\frac{1}{8}$ pint rose water; mix this with $\frac{1}{8}$ pound willow charcoal, and dry it thoroughly in a warm place. When the nitrated charcoal is perfectly dry, pour upon it a mixture of $\frac{1}{2}$ drachm each of the attar of thyme, caraway, rose lavender, cloves, and santal; then stir in 6 ounces benzoic acid. Mix thoroughly through a sieve, then beat in a mortar with sufficient mucilage to bind together. Make into pastils, and dry.

(12) J. E. E. asks: By what process is "graying" done—with acids—upon polished iron or steel, which is frequently preferred to "bluing"? A. By dipping or sprinkling with dilute nitric acid after heating until blue. 2. How to make a smelter for brazing iron or steel that will fuse at a lower degree than brass. A. By mixing a little more zinc or tin with the brass. Silver is better for steel solder.

(13) G. A. C. asks: 1. What is a good paint for steam pipes when exposed to a very high temperature? A. Finely pulverized plumbago and linseed oil is as durable as any. 2. What is used to mix gilt, gold, copper, etc., for painting steam heating apparatus? A. For ordinary bronzing, the metallic bronze powder is rubbed upon the paint when nearly dry, then varnished with thin mastic.

(14) E. S. asks: 1. Will a leather belt transmit as much power on rubber-covered pulleys as a rubber one? If not, about what is the difference? A. No; 50 per cent in favor of rubber belt on rubber pulley, when both are new. 2. What oil is best for a small lathe and like machinery? I have trouble with the oil gumming. A. Best cold pressed lard oil, with one-tenth kerosene.

(15) J. H. B. asks: What size engine and boiler will run a boat 22 feet long, 5 feet beam, and 3 feet deep, at speed of 9 miles or more an hour? A. 3×4 cylinder; vertical boiler, 26 inches diameter, 45 inches high; 20 inch wheel, 36 inches pitch.

(16) C. M. asks: 1. What can be used to render new patches in an old brick wall similar in appearance to the old? A. We know of no means of accomplishing such result. 2. I have seen something like a charcoal stick, which when burning at one end would cut glass. What is its composition and how is it made? A. Take sticks of soft wood (willow or poplar) of about the thickness of a finger, which must be thoroughly dry, immerse for about a week in a concentrated solution of lead acetate and then dry. See also "Simple Method of Cutting Glass," in Scientific American for October 31, 1885, page 275.

(17) Inquirer asks: 1. How can white country flannel shirts and drawers be washed without shrinking? Have hundreds to wash every two weeks, and the shrinkage soon renders the shirts too small for use. A. Care in rubbing and in the drying, after washing in tepid water, such as comes from experience, will make the shrinkage as little as possible, but the only sure way to insure such garments keeping their size is to dry them on forms, as do all the manufacturers of knit underwear. 2. What ingredients will form a wash to clean a brick church, now almost black, after 20 years' exposure in south side Pittsburg smoke? A. You will find the necessary information for cleaning brick walls in Scientific American Supplement, No. 21. 3. Can you give a poor sufferer from asthmatic and bronchial ailments a remedy? A. There is a long and very explicit article on "Bronchial Asthma" in Scientific American Supplement, No. 171, by John C. Thorowgood, in which he gives several of his remedies.

(18) A. S. asks: 1. Is there any means by which to give very small wooden globules a permanent black or brown color, simply putting them in the solution? A. Wash with a concentrated aqueous solution of extract of logwood several times; then with a solution of acetate of iron of 14° B., which is repeated until a deep black is produced. 2. Where and for what price a square foot could I buy thin sheet lead to protect a table against acids? A. It is worth about ten cents per pound, and can be procured from a dealer in chemical apparatus.

(19) E. E. B. asks (1) how to make a solution for silver plating, to be applied with a sponge or flannel to brass or copper. A. You can make solution for silver plating on brass, etc., by dissolving 1 ounce of nitrate of silver in 1 quart of rain or distilled water, and a few crystals of hyposulphite of soda are added which form a brown precipitate soluble in a slight excess of hyposulphite. Articles may be silvered by dipping a sponge in the solution and rubbing it over the surface of the article to be coated. 2. How to divide a circle into 360 parts. A. This is generally accomplished by means of a protractor, costing from 25 cents upward, which can be procured from any dealer in mathematical or drawing instruments.

(20) A. F.—The red coloring matter in thermometers is simply an aniline red dissolved in alcohol.

(21) W. J. S. asks the composition and mode of manufacture of the so-called "grease paints" used by actors in making up. A. The principle is to make a dry powder somewhat darker than the desired tint, and then thoroughly mix this powder with some bland oil (as almond oil) or some fat (as perfumed benzoated lard) or some perfumed paraffinoid (as petrolatum), in the proportion necessary to produce the required color and consistency.

(22) H. G.—Water will filter through a brick partition. See Scientific American Supplement, No. 451, on Filtering Cisterns.

(23) W. M. asks how to stain brass black; can it be done with fire or acids? It should be a dull black if possible. A. The best means for producing a black surface on brass or silver is said to be platinum bichloride, made by dissolving platinum in nitrohydrochloric acid to saturation. Dip the polished work or rub the solution on with a small pad of cotton. After blacking, the object is washed and lacquered.

(24) E. A. Y. asks what is the cement used for putting on stained glass substitute. A. Nothing but the best fish glue is used.

(25) G. M. W. desires (1) a receipt for preventing rust on the spokes of a bicycle. A. Boiled linseed oil will keep polished metals from rusting if it is allowed to dry on them. 2. How to brighten the nickel plating? A. Use a little rouge powder on a chamois skin.

(26) F. G. V.—Flowers may be preserved for many months by dipping them carefully, as soon as gathered, in perfectly limpid gum water; after allowing them to drain for two or three minutes, arrange them in a vase. The gum forms a complete coating on the stems and petals, and preserves their shape and color long after they have become dry.

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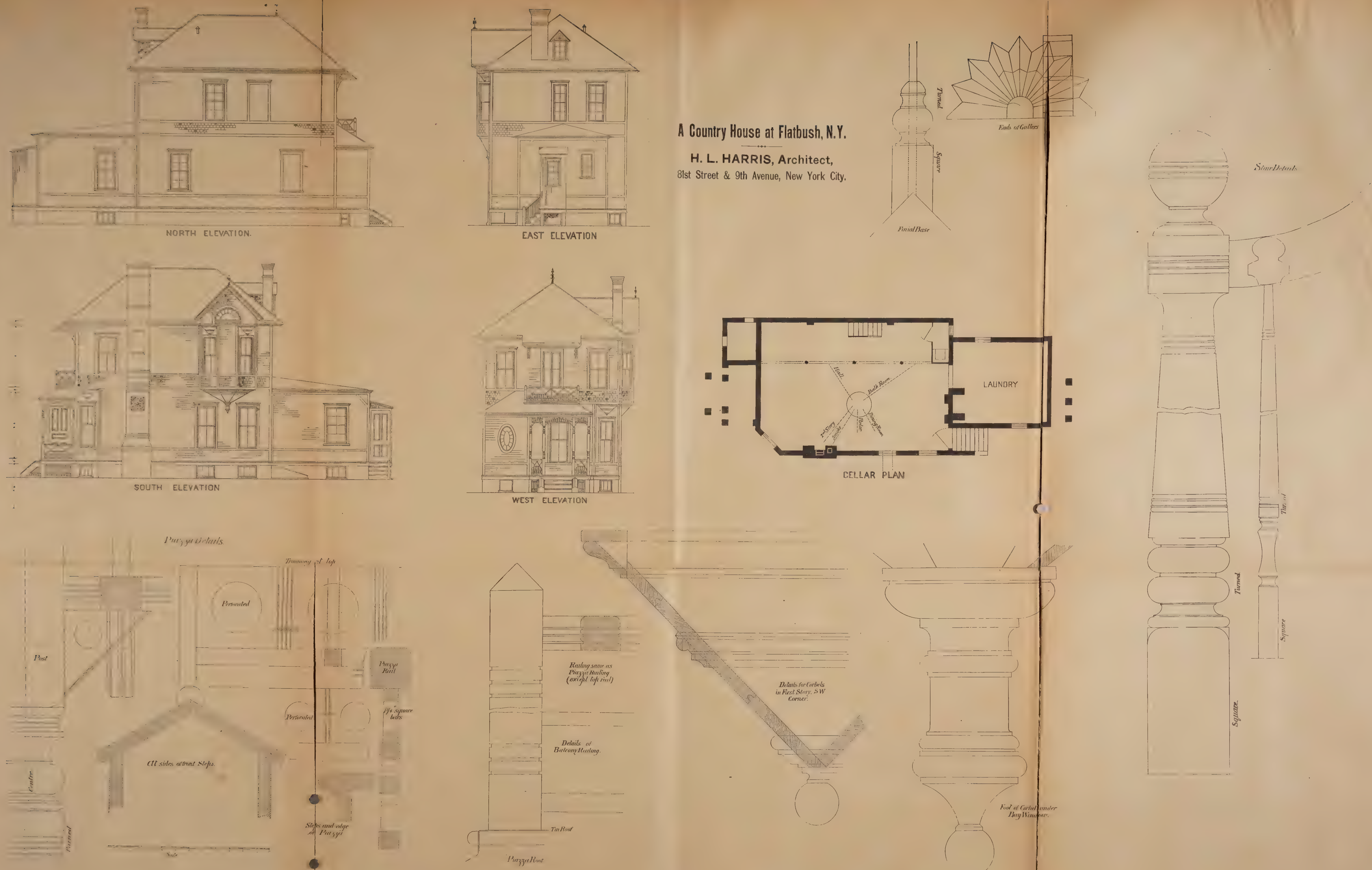

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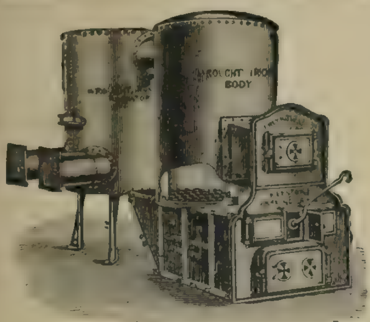

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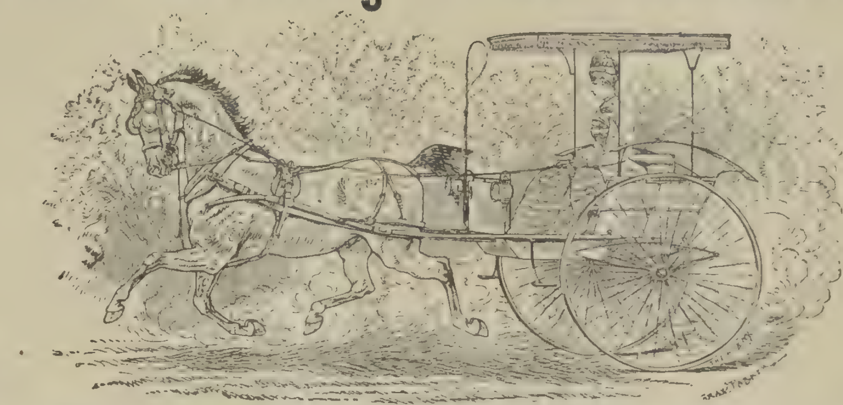

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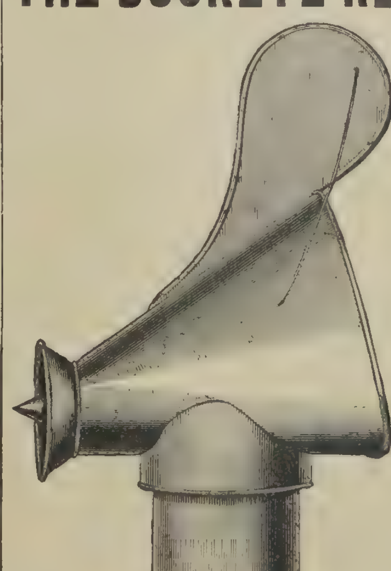

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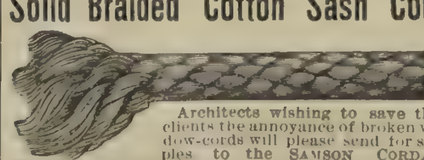

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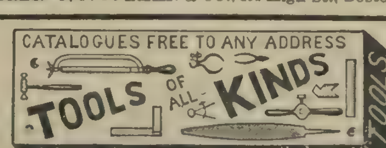

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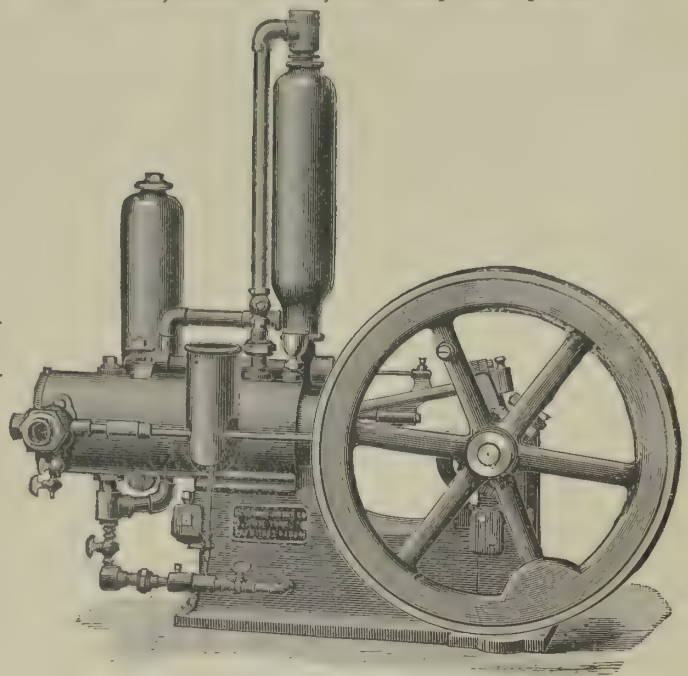
No. 6.  1 Man.

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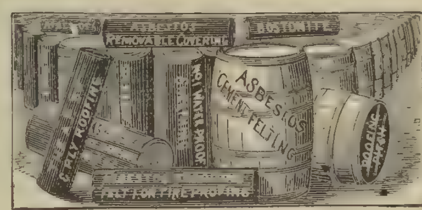

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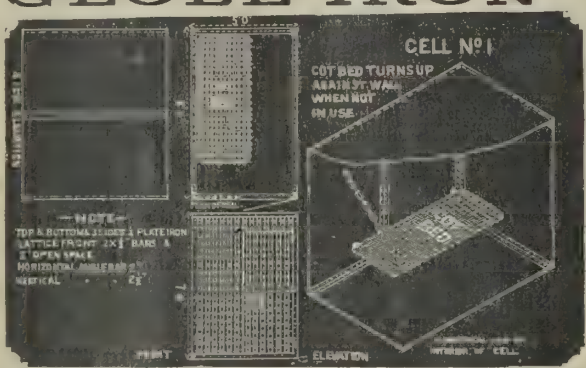

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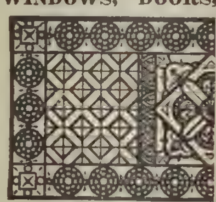

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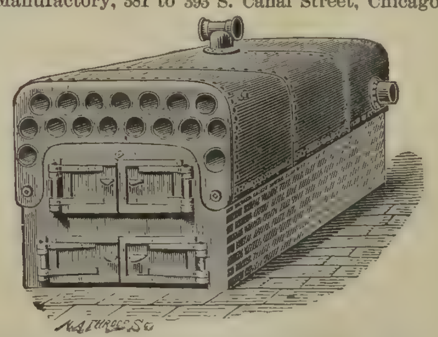

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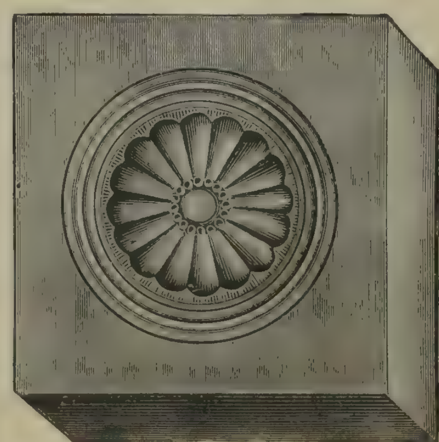

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MODERN SCHOOL HOUSE DESIGNS.

We present herewith a series of original designs for school houses, by Mr. C. A. Dunham, architect, of Burlington, Iowa, whose professional abilities are widely known.

Impressed with the idea that improvements in the architecture of public school buildings should be made, the author has prepared these plans to illustrate in some degree what can be done in a simple and economical manner.

These designs are not to be considered as cut and dried models, made to suit any and all localities, but to show certain combinations and what they can produce in certain pleasing effects. The cube and parallelogram used with a few gables here and there, and sometimes accompanied with a tower or two leaning up against the building, does not come up to the popular requirements for a pleasing exterior.

People generally speak of their intelligence through their works, and as their public schools are dear to them, there is no reason why they should be badly planned internally or inclosed with a barren, ugly exterior.

The work of the scholars and teachers is hard, and often, on the part of the latter, very monotonous; and when the building is ill ventilated or imperfectly lighted, the energies of both teachers and scholars are dulled, health injured, and taxpayers burdened without proper equivalent. Everything in our school buildings should be made to conduce and maintain the health of body and mind in our youths and teachers. Instead of prison and factory designed buildings, they should be made cheerful internally and fair looking externally. Common sense should be used in all things that pertain to these matters. There is nothing too good for our children and those who guide them in laying the foundation for knowledge and useful life.

DESCRIPTION OF THE PLATES.

Design No. 1, top of page 46, is a six-roomed house with accommodations for 150 children. Rooms are all well lighted, and flues prepared for a perfect system of ventilation. Basement under the entire building. Large wardrobe closets to each school room. Second story stairs of easy rise and tread and of good width. Heating to be by steam. Construction of wood or brick.

Design No. 2 is for a brick structure, simple in its form and arrangements, accommodating 240 pupils. Height of stories, 13 feet. Room on left, second story, 10 feet high on wall line, 14 feet in center. This building is well lighted and prepared for thorough ventilation and steam heating. Wardrobes and a recitation room as shown. Staircase with broad treads next to well hole, and a hall well lighted. The porch is a good and useful feature in this design. Basement under the entire building.

Design No. 3 is an eight room building, and would accommodate 500 children; and if it should become necessary for more room in winter, two more elegant rooms could be made in the attic. Basement under all; and if built upon a high piece of ground, as indicated, this would make half of the basement as pleasant as any part of the building. This building is a moderate costly one, and is very convenient.

No. 4, on this page, is a design prepared for Pierre, Dakota, and it will accommodate 360 pupils. It has all the appointments of the other designs. The hall room is ample, and the staircase is broad and well lighted.

No. 5 is for a union school for some of our larger inland cities, accommodating 750 children. This building is simple in its outline and decorations. Where ornamentation is used, it is of terra cotta. This building is well lighted and ventilated, has all of the other necessary appointments to make a perfect and complete building. Further particulars can be had by addressing the architect, C. H. Dunham, Burlington, Iowa.

SCHOOL HOUSE FOR PIERRE, DAKOTA.—C. A. DUNHAM, ARCHITECT, BURLINGTON, IA.

The Parisian Fire Department.

The fire brigade of Paris is not organized on as extensive a scale as Captain Shaw's, and, in consequence, several fires which lately occurred have not been extinguished as quickly as was desirable. It was also found that the people were not disposed to become amateur firemen. The Prefect of Police has therefore advised the various commissaries that the ordinance which dates from December 11, 1852, can still be put in force. According to it, all masons, carpenters, roofers, plumbers, and other workmen are bound, whenever requisition is made on them, to proceed forthwith to the place on fire and to bring their tools and ladders. Horses are also to be supplied on demand to the owners. Chandlers and grocers are under obligation to supply the torches which may be necessary in order to give light during the operations. The requisitions can be made by the commissary of police or the officer commanding the firemen on the occasion. It is not supposed that the work is to be gratuitous, for the labor and goods will be paid for on production of a certificate duly signed. But any person who will not comply with the requisition can be prosecuted. The Paris houses fortunately take a long time to burn, otherwise there would be little hope for them with so improvised a service.

Cast Iron Girders.

The use of simple cast iron girders for bridges appears to be limited only by the power to make sound castings (which arises chiefly from the difficulty of pouring the metal equally and the inconvenience of handling large masses). Mr. Rastrick, however, would not put any limit to the length. Mr. Hawkshaw considers that they may safely be made more than 50 feet long; in which opinion Mr. Fox and Mr. Grissell concur, but name 60 feet as the limit. Mr. Glynn, Mr. Charles May, and Mr. Joseph Cubitt would make them from forty to fifty feet. Mr. P. W. Barlow, Mr. Fairbairn, Mr. W. H. Barlow, and Mr. Stephenson state forty feet as the limit; and Mr. Brunel names 35 feet, as he does not consider that sound castings can be insured to a greater length. Mr. Fairbairn, however, mentions a girder in Holland 70 feet long cast in one piece. It appears to be universally admitted that the form resulting from Mr. Hodgkinson's experiments on the tension and compression of iron is that which gives the greatest strength; but the actual proportions are generally modified to suit the varying circumstances under which girders are employed. Mr. Stephenson sometimes makes the top flange equal to the bottom one, but usually in the proportion of 3:5, partly to obviate any risk from unequal cooling of the materials, and partly from the necessity of having a large top flange to bolt the flooring to. In preference to using a single girder, Mr. Stephenson recommends two girders to be bolted together, with a balk of timber between, to which the rail is fixed. Mr. Hawkshaw, Mr. Fox, and Mr. Joseph Cubitt recommend that the top flange be increased beyond the proportions given by Mr. Hodgkinson, in order to resist the lateral torsion. Mr. W. H. Barlow and Mr. Locke would use the arched form of girder whenever practicable, and the former gentleman says that straight girders have been in fashion, and consequently more used than practice actually required. Mr. Fox, in girders subject to dead weight only, would make the proportion of the top flange to the bottom one as 1:6, but in railway bridges he recommends 1:4. Mr. Thomas Cubitt mentions that shoes, or sockets, or any projections cast on girders, have a tendency to create flaws from causing the dirt to accumulate in those places, and he considers that the shape which will insure a sound casting should be as much considered as the theoretical form of greatest strength.

COFFEE-BEANS placed upon a hot plate or over hot coals throw off an aroma which is healthful and agreeable.

Architects.

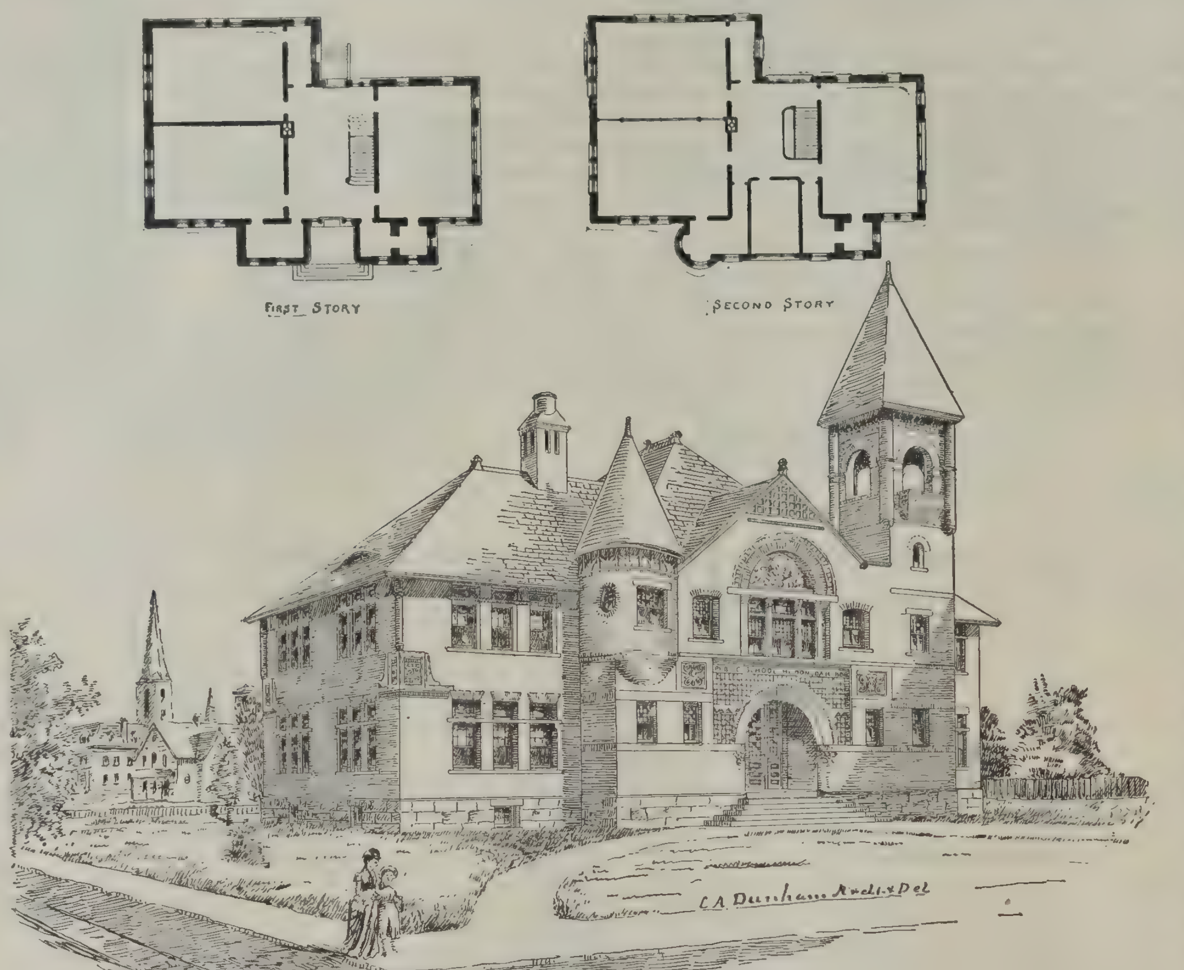
The complaints made by architects of the treatment they receive from clergymen and building committees indicate some very serious misapprehensions as to the money value of professional services. When an architect is asked to submit a plan, and the plan is used, it should be paid for. The stone mason and the carpenter have no stronger claim for remuneration than has the architect who conceived the design and rendered the execution possible by his drawings. If but a part of his design is used by being incorporated with some other design, he is entitled to some return for what is used.

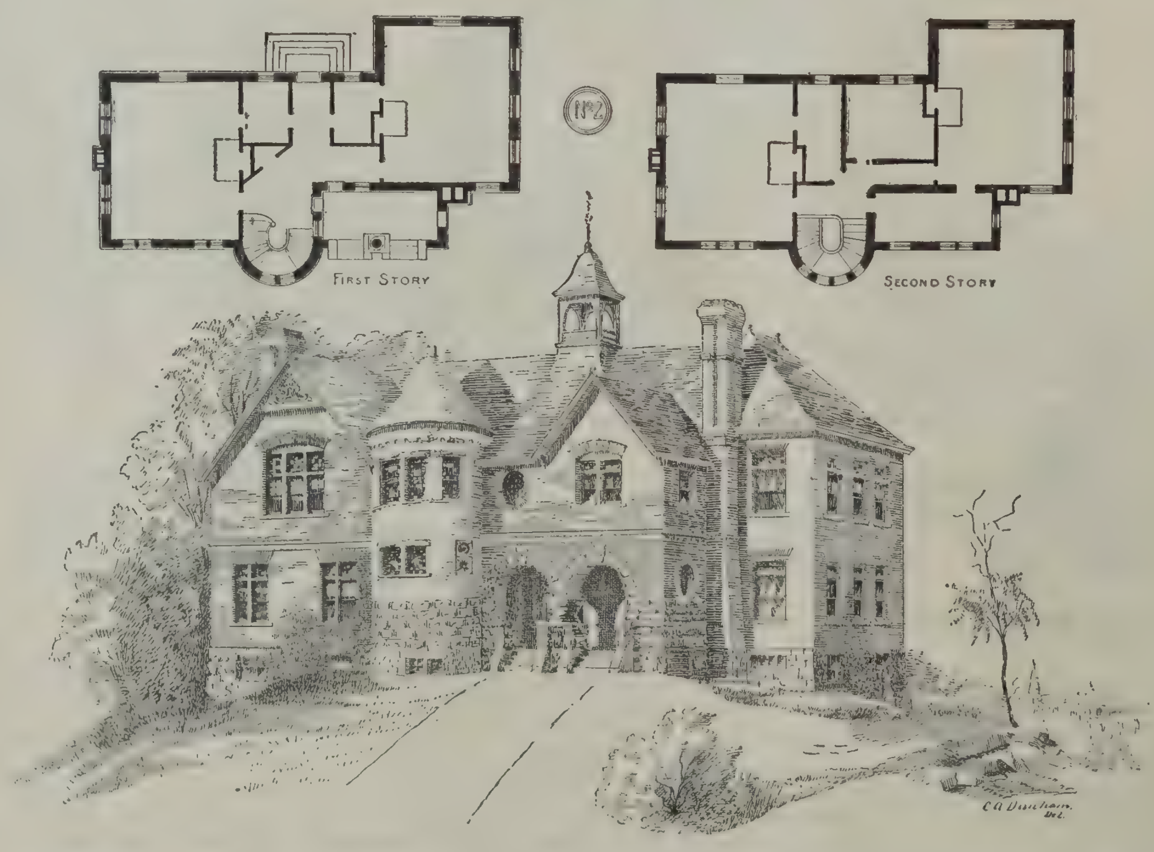
These are very obvious principles, but we are told that sometimes every other claim is met before the architect receives anything, and in other cases the ideas which have been carefully elaborated are appropriated without any acknowledgment whatever. Instances are recited where preliminary sketches have been handed over to builders, and churches and chapels constructed from them without even asking the permission of the architects, to say nothing of making no return for what certainly has as definite a value as the services of a physician or the advice of a lawyer. This breach of good faith has become so serious and so annoying that many architects refuse to make even a preliminary study until some positive contract for remuneration has been made. It is a misfortune, to say the very least of it, that persons having in charge the construction of religious edifices should ever exhibit ignorance or carelessness of the principles of fair dealing.

The writer prefers to think that there is rarely any positive attempt to take advantage of an architect, and that the abuses referred to grow out of ignorance of the value of the architect's work, and also out of the dread of paying too dearly for services which seem to consist simply in putting a few lines on paper. It must be borne in mind that the calling of the architect has grown in importance year by year because of the demand for tasteful and convenient buildings, and because the calling itself has been dignified by the training given the men who fill it. Whereas once the village carpenter or the master builder who could do a little sketching were almost the only architects, now we have men in every city who have gone through a long course of training, and whose preliminary education has been gained at as heavy an expense as that incurred by men in fitting themselves for the bar or for the practice of medicine. Year by year reliable builders recognize more fully the need of well conceived plans and of carefully prepared drawings, and rely more and more upon the judgment and skill of the architect. It has grown to be a calling of great importance, and its successes are seen in the superior convenience and finish of our churches and other religious edifices.

When, therefore, a parish or a mission thinks of building, it is almost absurd in these days of improved taste to try to get along without an architect; and if one is employed, his labors should be rewarded. There are various ways of employing an architect. Sometimes a parish will want not only drawings, but personal superintendence. After he has prepared all the working details, the master builder and the building committee look after the work in progress. Sometimes only preliminary sketches are required, if the building is simple, or if it is a trifling enlargement or alteration of an old building. But for all of these three classes of an architect's work there is a recognized money value, and it should be considered part of the cost of the building.

The dread of meeting this expense is the secret of many of the blunders in construction and of the violations of good taste so often met with. There ought to be nothing so cheerfully paid as the small fee necessary to gain good advice in putting up a church, a chapel, rectory, or any other edifice belonging to the parish. Besides this, there is nothing so economical as starting right and continuing under good guidance. It would not be difficult to point out new buildings where from twenty-five to fifty per cent has been added to the cost of construction and alteration, simply because of the effort to save a few dollars by not employing an architect. But, however this may be, the purpose of this article is simply to call attention to the complaint so frequently heard, and to save any of our clergy and building committees the reproach of failing to treat fairly a very honorable calling when it does have dealings with its representatives.—*The Churchman.*





MODERN SCHOOL HOUSE DESIGNS.—C. A. DUNHAM, ARCHITECT, BURLINGTON, IOWA.

Buying Houses "on Easy Terms."

"If these easy terms houses were just what they look to be," said the retired builder, "the deal would be perfectly square. But that is the costly rub. For instance, you want to buy a house for $3,000, and you pay $500 down and move in. Then you begin to pay off the balance at the rate of $20 a month. That's easy, isn't it? Just take your pencil, and figure it up. Twenty dollars a month is $240 a year. Interest at 5 per cent is one hundred and twenty-five; taxes and water-rent, sixty more, and the total is four hundred and twenty." "Thirty-six dollars a month?" "Pretty nearly. But that isn't all. There's the repairs, my boy. You're lucky if you don't have to put on a new roof the second year; your pavement is sure to need repaving; the plumber will call on you about six times a year, and, in short, you will soon find another hundred a year tacked on to your easy terms. Now, what do you naturally do?" "I naturally kick," I replied with considerable energy. "It won't do you any good," said my friend. "You've signed an iron-clad contract. You must pay or go." "Exactly," responded the ex-builder, with a genial grin, "that's just what 50 per cent. of the victims do. They do what they should have done first—figure it up; and it scares them. They look forward to 12 years of this sort of thing, and they see that they have the hot end of the poker; then they drop it." "Do you mean to say," I inquired severely, "that none of the money is returned?" "Well," said my friend, meditatively, "there was a rumor once that a contractor did return about a third of the purchase money to a certain man, but as I never could find either the man or the contractor, I guess it was a ghost story."—*Phila. Call.*

Marble.

The physical or external character of marbles constitutes the chief consideration with reference to their use for decoration or ornamental architecture, their color and internal structure being the most important. Their chemical character has reference more to the facility with which they may be converted into use, and their capability of receiving and retaining a certain polish. In their simplest and purest state, marbles chiefly consist of carbonate of lime, which is of a white color; the whitest kind, however, is frequently associated with quartz or silex, which more or less deteriorates it. This is more or less united both chemically and mechanically in various ways with nearly all the marbles. The variations in color arise chiefly from accidental causes, in the greater or less admixture of carbon, or the stains of various metallic oxides, or the sectional outlines of embedded fossils. Magnesia enters largely into the serpentine variety of marble. The more crystalline and least earthy marbles are the least durable, the compact or finely granular crystalline marbles being superior to those which are largely crystalline or of a slaty texture. Almost all the varieties burn into quicklime; several of them, however, exfoliate in the conversion before they become caustic, and fall into sand when exposed to the ordinary mode of separating the carbonic acid; such qualities are, therefore, very inferior for ordinary cement, as they make a costly and meager mortar.

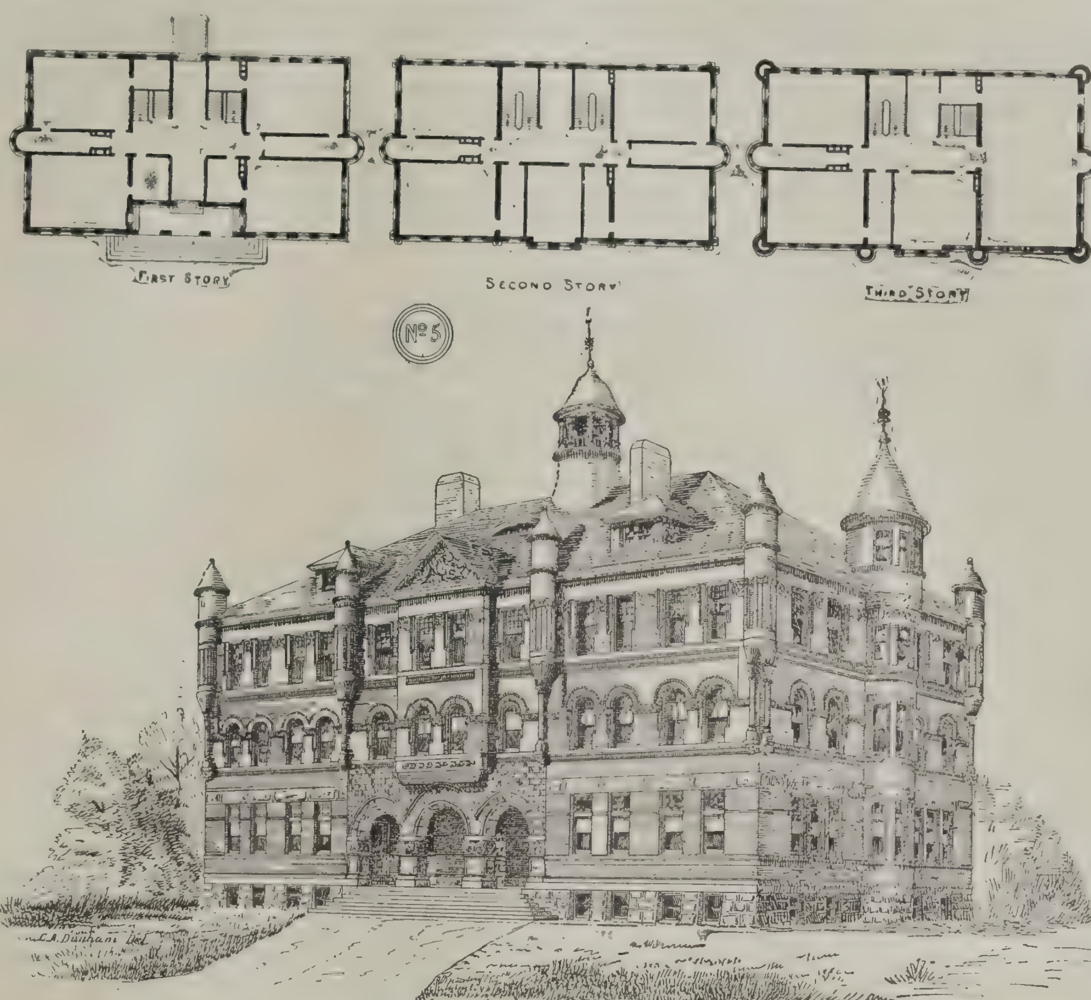
G. Wilkinson.

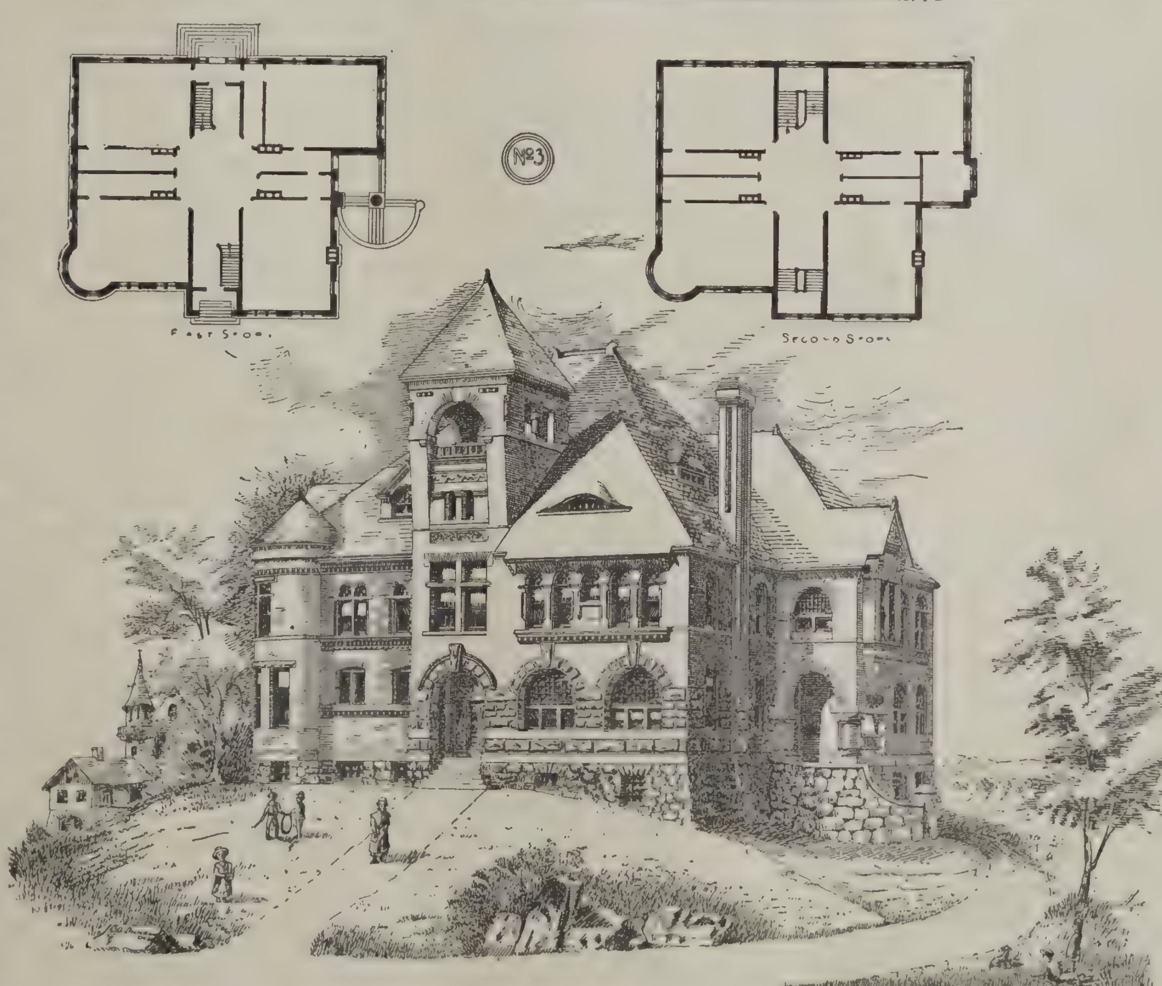
Mistakes in Building.

Owners are often sadly disappointed and grieved at their mistakes in the means adopted by them to avoid the expense of an architect, and obtain plans for their buildings. Sometimes they know or become acquainted with some "honest mechanic," to whom they are induced to intrust the whole matter of plans specification, and instruction, only to repent when it is too late. The party to whom the proposition is made, elated with the splendid opportunity opened to him, and full of conceit in his own abilities, uses all possible means to secure and consummate the arrangement, and plans are made—*and such plans!*—and the work progresses. Once under way, there is no stopping it, and step by step the owner discovers and realizes, one after another, grievous errors which are difficult to remedy. And when the building is completed he simply feels disgusted. Imperfect arrangement, poor construction, homely design, and incurable defects crowd upon him as the reward of his folly; and regrets for his error haunt him day and night, but it is too late—the building is erected, and he must endure its defects.

But the first general dissatisfaction is primary and bearable compared with after experiences in their various details. The plumbing work has, perhaps, been done by some tenth-rate man—some spoiler of good materials, who calls himself a "practical plumber," but who has not the slightest idea of what constitutes a really good job, not to say first-class. Nor would the payment of ten times the value of the work done secure skillful workmanship at the hands of such men, for the simple reason that they do not possess, and, therefore, cannot practice, mechanical skill and abilities. And owners who employ this class of plumbers are unfortunate indeed, But to continue, defects show themselves in all connections. Pipes, under the old free and easy rule, were put in of insufficient capacity, wastes entirely too small, and sometimes so cramped in making bends as to diminish their practical size one-half. "Tinker" instead of "wiped" joints; leaks at various points and places; wetting and spoiling ceilings and walls, and frequently carpets have to be torn up to escape the deluge. All this is followed by a still more serious defect—one affecting the health and lives of the occupants, viz., imperfect or insufficient traps, pipe ventilation, bad sewerage, etc., resulting in the distribution of the vicious and poisonous sewer gases through the building, and, as a consequence, the ill health and sometimes premature death of loved ones. The intended pleasant home is thus transformed into a mere fume castle, a disease-breeding charnel house, not fit for human habitation.

All this is followed by continual repairing, tearing up floors, removing finishes to get at concealed places, etc.; and for all this the owner has been made to pay a good round price, amounting to more, as a rule, than it would have cost him to have secured a good building, erected under the superintendence of a trustworthy architect. But bad plumbing work is not the only serious defect which so often occurs in such cases. The foundation is often wholly insufficient, and settling occurs, with any quantity of ugly cracks in the plastering. The structure is perhaps so poorly braced that the edifice trembles with every wind that blows. And when the rains fall, leaks are found at every exposed window and opening, and the roof itself yields its proportion of internal wettings. But we will not continue our enumeration of "bad things," as to do so would consume columns of space. Such cases are known to all architects, and many a "served him right" is indulged in, upon the principle that a competent physician laughs at the sufferings of a patient whose pains and agonies result from self-treatment or quack practice, and the educated lawyer smiles when his client gets himself into a *terrible fix* by intrusting his case to some pettifogger, or who tries to work out the intricacies and problems of law by his own self-conceived legal ingenuity.—*Trades Journal.*





MODERN SCHOOL HOUSE DESIGNS.—C. A. DUNHAM, ARCHITECT, BURLINGTON, IOWA.

The Latest and Greatest Gun.

The house of Krupp is stated to have completed a cannon 46 ft. 8 in. in length, weighing 125⅛ tons, and having a caliber of 16 in. The monster has been turned out to the order of the Italian Government.

Ornamentation of Rooms.

A soft and pretty tint for the two bed chambers on the north side of the house will be old pink of medium depth—a pinkish terra cotta shade, as it is now called; tint the ceilings in a fainter tone of old pink. A frieze of golden olive ground with a pretty wild rose design on it, with olive greens and yellow in the foliage and pinks in the flowers, will make the wall much more finished; it can be a paper frieze. The parlor and sitting room, supposing they are on the south and have peacock-blue and bronze and green shaded carpets, are susceptible of two treatments—namely, a light treatment and a dark one. For the former, a lemon-yellow tint for the walls and a paler shade for the ceilings; or an old gold for the walls and lighter shade of same for the ceiling. For a darker treatment, bronze green for the walls and pale yellow for the ceilings.

With either coloring, have a frieze of rich design in paper with a flock ground of bronze green to harmonize with the lemon-yellow, or deep lemon-yellow if you use a bronze green; if you use old gold coloring on the walls, let the frieze be dull peacock blue. This will not be very expensive, and will greatly improve the appearance of the wall. This frieze should have a picture rail of wooden mouldings painted and gilded. From these mouldings, with brass picture rod hooks, you can suspend all your pictures, and thus obviate driving nails in the walls. Paint woodwork a bronze green, and the two bed rooms in buff, which will harmonize with the old pink of the walls.

Sitting room and parlor furniture should have ebonized frames or mahogany-finished cherry frames, or be in pieces of both; black walnut will not look well. The ebonized pieces will look well upholstered in copper-colored reds. Rather light peacock-blue or blue-green felt will be handsome for the parlor windows. For the sitting room use double-face canton flannel of the same color or copper-red; copper-red would look well in the parlor also. Holland shades of deep ecru tint will suit in the rooms. Ash furniture will look bright and cheerful in the sitting room. Hang the parlor curtains by brass rods; of the sitting room, by ash rods and rings.—*Art Interchange.*

Fast Time.

The newspaper train on the New York Central on Sunday made a remarkable run, the time between Syracuse and Buffalo being claimed to be the fastest ever made in this country over the same distance. The train, which consisted of a coach and baggage car, is due to leave Syracuse at 9:25 A. M., but on Sunday it was 10 o'clock before the start. The train, which was drawn by engine No. 541, John Cool driver, was in charge of Peter Wagner as conductor. The train was put to its best speed, and the run of 149 miles to this city was made in 144 minutes, including a stop of 6 minutes at Rochester, leaving the actual running time but 138 minutes. The fastest run was from Syracuse to Fairport, 70¼ miles, in 61 minutes 20 seconds; from Syracuse to Rochester, 81 miles, being made in 72 minutes, and from Rochester to Buffalo, 68 miles, in 66 minutes. For a part of the time, mile after mile was traveled in less than 52 seconds.—*Buffalo Express.*

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CONTENTS

Of the September number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

Back Numbers.

At present we are able to supply to new subscribers the back numbers of this journal from its beginning in November last. Each number is accompanied by a sheet of colored plates and a sheet of details.

DECORATION.

Rapid strides have been made both here and abroad during the past few years in the matter of the decoration of our houses, and although the improvement is marked and undoubted, it still leaves much to be desired. In houses of the smaller class especially, where the decoration is confined within moderate limits of cost, there is considerable room for improvement.

The decoration of rooms by the use of paper hangings is so inexpensive and convenient, and at the same time effective, that it is rapidly increasing in favor. Where they are used, it is the best plan to choose them as the first step in the decoration. Frequently the selection is made in the paper manufacturer's store, but the proper method is to choose each paper in the room in which it is to be used, for in this way one is enabled to observe it under the conditions of light and shade peculiar to the room itself, and can observe the effect of such conditions and the contrast between the colors of the furniture, paper hangings, floor cover, etc., and judge more accurately of the final effect when it is put upon the wall.

Paper hangings should never be chosen from a book of patterns, for it is almost impossible for any one who has not had considerable experience to judge of the effect from a small piece, such as will be found in a pattern book, and much disappointment has often arisen from this very cause. A paper in a small piece looks very different from its appearance when on a wall. The method of choosing papers which is recommended is to make a careful search through the pattern book, and to select two or three patterns for each of the principal rooms. The paperhanger should then bring one or two rolls of each of the papers chosen and pin them on the wall to the full height of the room, so that they may be viewed in the actual position they are to occupy. There is a further advantage in this method, which is that the eye does not get dazzled and the mind confused, as they are sure to do if a large number of patterns are examined in quick succession. Decorators all know how often people, choosing hangings and colors, will, from this cause, finally decide on what they at first rejected, and without having the smallest idea that it is so.

Having decided upon the papers, the colors for the woodwork will next be chosen to match. It is impossible to lay down any hard and fast rules as to the colors to be employed, so much depends upon the situation and aspect of the room, the kind and color of the furniture, and the individual taste of the owner. Do not, however, use graining. Happily, the system is rapidly dying out, although in the smaller and simpler class of houses it still retains its hold. Graining is objectionable from an artistic point of view, because it is a sham, but the effect of using plain colors is so very much more pleasant that it is difficult to understand how the more expensive and so much less artistic method could have remained popular for so long.

The woodwork, then, should be painted in plain colors, in two or more tints, the panels being always a lighter tint than the stiles and rails, with the mouldings picked in with a more decided tint or color. Drawing rooms, or parlors, should, as a rule, be finished in more delicate tints than dining or morning rooms. The decoration of a drawing room will be almost decided, or at least considerably modified, by the style and color of the upholstery. The writer has obtained excellent results from a variety of grays relieved with gold. In one case a paper was chosen of a decidedly light gray of a really beautiful design, but it had rather a cold appearance, as, indeed, that color always has in decoration, unless very carefully treated. The woodwork was painted in grays of three different tints, the stiles and rails being light gray, the panels lighter and the mouldings the darkest. The whole of the work was finished with a flatting coat of paint mixed without oil, to give a perfectly flat, dead surface, and a very small member of the moulding was run in with leaf gold. The decoration of the ceiling was carried out in three grays, to accord with the other portion of the decoration, the result being exceedingly satisfactory. The decoration of this room was quite inexpensive, and might be followed with advantage. The flatting has a very good appearance, and is, moreover, useful in hiding any inequalities in the woodwork.

The use of gold-leaf as an article of decoration must be very carefully limited. A free use of gold will make the best room look gaudy and glaring. Some decorators object to its use altogether; and although they undoubtedly err on the right side, its use need not be absolutely forbidden. It may be taken as a general rule that its use should be strictly limited to throwing into relief some feature of the decoration, but it must never be used in such a manner that the force of the decoration depends upon it. As illustrating the proper use of gold, a case may be referred to in which a room having a frieze and heavy cornice was decorated in good taste, but in somewhat insipid colors. The addition of a very thin line of the bright brick red sometimes called "Pompeiian red" on a member of the frieze immediately above the line of paper entirely altered the appearance of the room, and considerably improved the effect. The use of gold should be the same as the bright red in this case, used very sparingly and with the one and decided object of emphasizing the decoration.

The ceilings of the rooms of our ordinary houses are neglected in a conspicuous manner, generally being little more than a white blank expanse, with a cornice or perhaps frieze of more or less tasteful design. A ceiling lends itself very readily to the purposes of tasteful decoration, and should never be neglected. There are many methods of decorating it, among which that of picking out the cornice and stenciling on a border in one or more colors, to accord with the decoration of the remainder of the room, is one of the most simple and effective. In whitening ceilings the custom is, as a rule, to mix a small quantity of blue with the calcimine to increase the apparent whiteness. Where a color is used for the decoration throughout a room in varying tints, the color of the calcimine should be just broken by the addition of a small quantity of the same color, and the effect will be to bring the ceiling, as it were, within the system of decoration, and to considerably heighten the good appearance. H. S. J.

DRAWINGS AND CONTRIBUTIONS.

To those of our readers who have a mind to employ their leisure time in writing articles for this paper, we would say, the editor will be glad to receive their contributions, and will publish such as are approved.

Articles on practical subjects, aimed to interest and instruct every class of artificers connected with building, are especially desired; and for such articles special arrangements will be made.

Architects and builders who have desirable plans of buildings, which they wish to see illustrated in our columns, are invited to send them in. For colored plates, we need copy colored up as intended. For ordinary illustration, the drawings should be executed in black lines. We aim to give prominent credit to the authors of new designs. Those whose drawings have been issued have derived therefrom much benefit, owing to the very wide publicity thus given to their names and work specimens. It should not be forgotten our Building Edition now has, by far, the largest circulation of any architectural periodical in the world.

OUR FIRST VOLUME.

The first volume of our ARCHITECTS AND BUILDERS EDITION is now ready for delivery, bound in handsome paper covers. Price, $1.50. To be had at this office, and of book and news dealers throughout the country. Those who have not seen a half year's collection of our numbers bound together will be surprised at the wealth and variety of contents which the volume presents, as well as at the cheapness of the price.

The volume contains all the numbers of the work from its commencement up to and including June, 1886. It embraces sixteen splendid plates in colors, representing the perspective elevations and plans of various dwellings, all having attractive features; eight large double sheets of details of construction of the same structures; nearly one hundred additional engravings of architectural subjects, public works, buildings, dwelling houses, cottages, etc., with plans; and upward of three hundred other engravings, mostly of superior character, illustrative of works and subjects interesting to architects and builders. Including all the separate diagrams and engravings of construction details, the volume presents not far from one thousand illustrations. The reading matter covers a large variety of useful and excellent subjects, interesting to every one. No architect, builder, contractor, engineer, or householder can afford to be without this splendid work. It is beautifully printed, and is by far the cheapest architectural volume ever presented to the public.

Coloring Billiard Balls.

M. Guyot (*Repertoire de Pharm.*) says he was asked to redden a billiard ball, the color of which had been worn away in use. He had nothing but fuchsine at hand, and he tried to redden the ball by macerating it in an alcoholic solution of that coloring matter. This, however, did not answer at all; the color wiped off completely. After a few experiments, he found the following plan answer perfectly: To pass the ball rapidly through a bath of nitric acid, then wash it in plenty of water, and, finally, dip it into an alcoholic solution of fuchsine. The color is fixed instantaneously; the ball is washed, and polished with a piece of flannel.

Rustic Structures.

Ornamental summer houses, rustic fences, rustic bridges, settees, chairs, vases, etc., add an attractive feature to the landscape of a country place. Mr. John Wheeler, of Orange, N. J. (see advt. another page), has erected a large number of ornamental structures of a varied kind in Llewellyn Park and on the premises of other residents of Orange and vicinity. These varied rustic structures, scattered here and there through the park and on lawns, are the admiration of strangers, and they add more attraction to a country place than their cost to construct.

COTTAGE AT BLOCK ISLAND, R. I.

A seashore cottage again forms the subject of a portion of our colored sheet this month. The house has lately been built by Everett D. Barlow, Esq., on the south coast of Block Island, R. I., at a cost of $3,200.

The drawings show a well arranged plan, with the usual features of seashore houses in the large piazza and the hall and parlor, forming together one large reception apartment. The elevation, with its octagonal tower, is well and attractively designed, and the cheerful colors used for the finish are well chosen. The body of the house is an olive green, relieved by maroon and "old gold" trimmings. The front door is of solid cherry, and the small panes in the upper part of the windows and front door are filled in with colored cathedral glass, adding considerably to the appearance of the house.

The interior woodwork is planed smooth and sandpapered, and finished with two coats of shellac. The hall is stained cherry color, and is rubbed down to a dead face.

Mr. Charles E Miller, a rising young architect, of 149 Broadway, New York, is the author of the design.

SPECIFICATION OF THE WORK AND MATERIALS TO BE EMPLOYED IN ERECTING A COTTAGE AT BLOCK ISLAND, R. I., FOR EVERETT D. BARLOW, ESQ.

GENERAL CONDITIONS.

The contractor is to give his personal superintendence to the work, and to furnish all transportation, labor, material, apparatus, scaffolding, and utensils needful for performing the work in the best manner, according to the true intent and meaning of the drawings and specifications, which are intended to be co-operative. and when anything is shown on plans and not mentioned in specification, or *vice versa*, the same is to be furnished as though it were both shown and specified. This specification and the drawings annexed are intended to include everything requisite and necessary to the proper and entire furnishing of carpenter's, mason's, plumber's, and painter's work, and the same shall be furnished, notwithstanding every item necessarily involved in the above works is not particularly mentioned.

All work, when finished, to be delivered in a perfect and undamaged state, without exception.

Except where otherwise specified, all materials to be of the best of their respective kinds, and all labor to be done in the best workmanlike manner, to the full satisfaction of the owner. Should the contractor introduce at any time materials different from the sort and quality herein described, the same shall be removed and made good at the contractor's expense.

The contractor will be held responsible for all portions of work let to him. The contractor shall make no alterations of the drawings or specifications, but should any error or inconsistency appear in these, it shall be the duty of the contractor to duly notify the architect, who will make proper adjustment. The contractor is to give to the proper authorities all requisite notices relating to the work in his charge, obtain official permits and licenses for temporary obstructions and pay all proper fees for the same, and is to be solely answerable for all damage to neighboring premises, or to the person or property of the public, by himself or his men, or through any operatives under his charge, whether in contract or extra work. The contractor is to protect his work from frost until the building is finished, and on completion of building to cart away all rubbish and leave the whole broom clear. All drawings as instruments of service are the property of the architect, and shall be returned to him on completion of the work.

CARPENTER.

Scantling.—Sill, 6in.×6in., halved and pinned at angles; plates, 4in.×4in.; posts, 4in.×6in.; girts, 4in.×4in.; braces, 2in.×4in.; studding, of spruce, 2in.×4in. All studding will be planed on four sides.

Partition caps, 3in.×4in., planed on three sides.
" soles, 2in.×4in., " " " "
First floor beams, 2in.×10in.—2·0in. on centers.
Second floor beams, 2in.×8in.—2·0in. " " (planed).
Attic " " " " " " "

All beams under partitions to be doubled and spiked. The headers over main stairs will consist of three spiked together; trimmers will be the same.

Rafters, 2in.×8in.—2·0in. on centers (to be cut on ends).

Hip rafters, 2in.×8in.

Valley, 3in.×10in.

Veranda.

Girders, 4in.×8in.

Floor beams, 2in.×6in.—2·0in. on centers.

Rafters, 2in.×6in.—2·0in. on centers (planed and cut on ends).

Plate, 4in.×8in. (planed).

Posts, 4in.×5in. (chamfered and planed).

Brackets, 4in.×5in. (chamfered and planed).

Veranda posts of clear white pine; all other timber of spruce.

Veranda roof timber will be exposed and dressed.

Framing.—The house to be framed and braced in a perfect and substantial manner, and to be perfectly plumb and true; all beams will be spiked together where practicable, so as to form ties across building; all framing of beams to be fitted with tenon and tusk. Roof to be strongly framed and tied.

Gutters.—To be of galvanized iron and to pitch to leaders. Leaders will be 3in. in diameter, and placed where directed by owner, so as to throw water into cistern.

Gable and Finish.—Gable and dormer as shown; shingles in gable to be of redwood, oiled with three coats of oil. Shingles on dormer to be of sawed pine.

Roofing.—Cover all roofs with sawed pine shingles, three (3) shingles to the lap, to be nailed on shingle laths about 7in. on centers; all valleys to be flashed with tin, which will be well run up under shingles; flash chimney and dormer and around tower. Roof of veranda to consist of pine boards, planed on one side. Over this nail shingles. Flash around junction of roof with wall of house. Balcony floor to be calked with oakum and tar.

Wall.—The wall studs to be covered with good ⅞in. pine boards, nailed vertically, with bead in center and on end, to be tongued and grooved, and firmly nailed with galvanized iron nails. Planed on both sides, fit between the partitions the same stuff, which will have a small bead nailed on, so as to keep panels in place.

Size of boards, not more than 5in. wide.

Base.—Form base of 1¼in. thick pine.

Casings.—To be 1in. thick and 5in. in width.

Piazza.—Construct veranda as shown. Balusters, 1½in.×1½in., top; rail, 3in.×3in.; bottom, 2in.×3in. Floor to project, and rounded, tongued and grooved pine, ⅞in. by not more than 5in. wide.

Outside steps, ⅞in. thick; riser, 1¼in. thick. Tread rounded and returned on sides, all supported by 2×10in. strings.

Flooring.—First and second floors of good yellow pine, tongued and grooved, and not more than 5in. wide and ⅞in. thick; third floor of white pine, 5in. wide.

Partitions.—Set all partitions with 2in.×4in. studs, planed on all sides, as previously described.

Interior Finish.

Stock.—All the stock for inside finish is to be best quality, well seasoned, smoothed and sandpapered, and, unless otherwise specified, of white pine. Hardwood saddles for all doors and hearths.

Architraves.—All doors and windows to have a 1in.×5in. plain architrave, with moulding and bead on edge.

No splicing allowed.

Doors.—Front door to be 2in. thick, of design shown on elevations; all other doors will be 1½in. thick, four paneled, and unless otherwise shown will be 2ft. 6in.×7ft.

Door Frames.—All door frames to have 1⅜in. thick jambs, with stops nailed on.

Window Frames.—All windows, unless otherwise shown, to have box frames, with pockets; sills, 1¾in. thick, plowed to receive stool, and to pitch 1in.

All sashes to be 1⅝in. thick, with lights as shown, and to have moulded sash bars. All to be double hung, with best steel axle pulleys (which carpenter will furnish), hemp sash cord, and iron weights (which carpenter will furnish). Cellar windows, 1¾in. thick; plank frame sash, hinged at top, and have three lights. (Sill to be rebated for blinds.)

Sink and Basin.—Make a strong basin to support sink and drips. Drips of yellow pine grooved so as to drain water to sink. Frame covered with white pine tongued and grooved sheathing boards; door under sink and drip. Basin on second floor to have a yellow pine board with hole in center for basin.

Closets.—Fit all closets, except as otherwise specified, with one shelf and cleat under for hooks. Pantry, kitchen, and dining-room closets to have six (6) shelves strongly supported.

Blinds.—Provide and hang to all windows on first and second floors first quality 1in. outside blinds, divided and hinged so as to fold back neatly; all to have rolling slats.

Hardware.

Owner will furnish hardware, and carpenter will put the same up.

Stairs.

Main Stairs.—Open string, 2in.×12in., string beaded; treads, 1¼in. thick; risers, ⅞in. thick; all to be clear seasoned stuff; pine nosing carried around side of string. Newels, 5in.×5in., turned. Balusters, 1½in.×1½in., turned. Rail, 3in.×4in. All of cherry.

Cellar and Attic Stairs.—To have 1in. pine treads with 2in.×10in. string. Attic will be same, except that on the under side of treads will be sheathed with pine nailed to treads.

PAINTING.

Redwood shingles to be oiled with three coats of linseed oil. Pine shingles painted as below described. Paint all exterior work with two coats of best white lead and linseed oil, in colors as directed. Painter will calculate to paint corner to imitate corner-board. Rail balusters and newels to be filled, and to have three coats of hard oil rubbed to a dead finish. All interior woodwork to receive two coats of shellac or Wheeler's hard finish.

Glazing.

All glass will be double thick American of number of lights shown, all to be well puttied and tacked, thoroughly cleaned and left whole and perfect, all small lights and thin covered attic window to be cathedral glass.

MASON'S WORK.

Excavation.—Excavate for all cellar wall, piers, etc., as shown, also, for cesspool and cistern; dump the earth from excavations where directed, and leave the premises clear, after building is finished.

Cement, Lime, and Sand.—All lime used in the mason's work to be extra No. 1 Rockland lime cement, of best quality; Rosendale of approved brand; sand to be clean and sharp; all to be used in proper proportions.

Foundations.—Furnish all materials (except stone), and build walls, unless otherwise shown, 1ft. 6in. thick, of stone laid in lime and cement mortar in equal proportions, and clean, sharp sand in proper proportions, the whole to be well bonded and trowel-jointed inside and out.

Bluestone.—Furnish and set hearths of sizes shown of rubbed bluestone. Lintel of kitchen fireplace to be the full size of breast, 6in.×8in. thick, rubbed. Cap of chimney of size shown, quarry axed, 3in. thick.

Brickwork.—Brickwork of chimney to be selected brick on exposed portions in each room and outside, laid in red lime and cement mortar. Flues, 8in.×8in., and worked smooth. Set a 5-inch thimble in each room on second floor, 2ft. 6in. above floor.

Trimmer Arches.—Turn 4-inch trimmer arches to fireplace openings, and level off bed with cement on line with hearth.

Cesspool.—Build circular cesspool where directed, of stone, 6 feet in diameter and 8 feet deep, draw in top and leave manhole, covered in with large stone.

Cistern.—Build circular cistern where directed of stone; size, 6 feet diameter and 7 feet high; wall to be made perfectly tight with cement.

Drain.—Vitrified pipe, etc., will be furnished by owner. Mason will leave hole in the foundation for pipes, where directed. Dig trenches where directed by carpenter, and fill in with stone for a foundation for all outside steps.

Tiles.—Mason will set terra cotta tiles, which will be furnished by owner. To be set in crest of parlor fireplace.

PLUMBER.

Galvanized iron leading from tank to the basin and sink will be ¾ in. diameter, joints well put together.

Iron Pipe.—There will be a 1½ in. galvanized iron pipe to drain basin on second floor to the waste pipe of sink; also 1½ in. galvanized iron pipe leading from pump to tank. There will be a 1 in. galvanized iron pipe for overflow of tank to empty into sink; also a 2 in. cast iron pipe and trap to waste sink into drain. This pipe to have a branch to receive pipe from basin, which will be connected into the hub of C. I. pipe. All connections of iron pipe will be with molten lead and oakum. All galvanized iron pipe to be connected with tenons, so as not to leak.

Pump.—Pump will be furnished by owner, but plumber to make all connections for tank. There will be two lever cocks, one for spring and one for cistern water.

Basin.—Plumber to furnish and set to wooden slab a 10 in. imitation marble basin; these to be supplied through a ¾ in. bulb cock, placed high enough to get a good-sized pitcher under. And waste through a brass socket plug (with chain), connected with the galvanized iron waste pipe.

Sink.—Sink to be furnished by plumber, of the following size: 30 in. × 16 in. × 6 in., plain cast iron with iron back, supplied with a ¾ in. brass bulb cock, connected with pipe from tank and wasted through a 2 in. cast iron waste pipe, with an S trap to connect with main drain.

Tank.—Plumber to supply a tank of the following size: 3 ft. × 4 ft. × 3 ft., lined with tinned and planished copper, to be made of pine 2 in. thick, so as to be dovetailed, and the whole to be strongly put together. Tank to have lid with holes bored in it, and a fine brass sieve under, so as to keep vermin out and afford some ventilation. Make all connections, as previously described.

A SUBURBAN RESIDENCE.

H. S. RAPELYE, ARCHITECT, MOUNT VERNON, N. Y.

The accommodations of this handsome residence are complete—all that one could wish in a well-appointed house. The perspective in colors and elevations on extra sheet, which are given, sufficiently show the construction of the exterior. Mr. H. S Rapelye, architect, of Mount Vernon, Westchester Co., New York, is the author of the design. The cost of the structure, it is calculated, will be $7,000.

Size of structure: Front, 32 ft.; side, 52 ft., including extension. Height of stories: Cellar, 7 ft.; first story, 10 ft.; second story, 9 ft. The floor plans show the size of rooms. Materials: Foundation, brick and stone;

reception room, bow window, local stone; first story, clapboards; second story, shingles; gables, scalloped shingles; roof, slate. Cellar under the whole house. Three good bed rooms in the attic, and a laundry in the extension. A handsome gabled porch kept well up from the ground line and the gable balcony forms a very new and worthy feature. The parlor windows open on veranda, are large, and extend to the floor.

Looking at the interior of the house, it will be seen that the arrangement of the rooms and general planning have been well considered. The large hall and the staircase shown on the plan will form a striking and important feature of the interior, and the rooms are all of a conveniently large size; with the sliding doors to the hall thrown open, the floor is practically one large room.

In the second story are four chambers, the front one having an angle fireplace and mantel, and a large corner bay window.

The chambers and the hall are heated from the furnace by registers. A spacious bath room in the rear contains bath, water closet, and a marble wash bowl, and is also heated by a register in the floor. All the rooms on the second floor are provided with ample closets, and the stairs to attic and down to kitchen are well planned. The exterior and interior details shown in the illustrations are of attractive design, and will form an example of the general finish.

The interior trimmings are whitewood; stairs, oak; mantels, oak and cherry; hearths and facing, Minton tile; plain bronze hardware on first floor, black porcelain and bronze on second story; F. T. Davis' automatic sash fasteners to each window.

In a fine open site, well planted with trees, this design, with its irregular, picturesque plan, will appear to advantage, because the whole aspect of its surroundings will be likely to suggest the idea of precision and accuracy, and the artistic eye can hardly fail to perceive the propriety, under such circumstances, of a well-defined, self contained composition.

Fixing Weatherboarding and Doors.

The following method of weatherboarding is not generally known, and is a great saving of time on the usual method of gauging with compass and using set nails every few feet. When the frames are set ready for weatherboarding, take a rod, and, having measured upon it the full height from the starting of weatherboarding to the top of window or door frames, space it off in proper distances for the weatherboarding to show to the weather. Then take another rod and get the distances between each opening, marking the same upon it. Count the number of pieces required for each space and proceed to cut the required lengths, squaring the left hand end. By these means every piece of board may be cut with as little waste as possible. Now pick up a piece (standing at the right hand end), put the left hand end, which is squared, against the casing or corner board, put the weatherboarding hook over the board and against the casing at the right hand end, and mark it accurately; take down and saw and then put it up in its place, when it will fit sufficiently tight to hold without nailing. After a little practice of this method the block plane need not be used at all, and one can place six or seven boards in position before picking up the hammer to nail them. The frames and corner boards being all regularly and properly spaced, it is not necessary to gauge each board, nor to use set nails, which effects a considerable saving of time, besides which, the spacing on different corners will insure the boards being all on a perfect level, and the method will therefore have the further advantage of producing more accurate work.

A second method of a somewhat similar kind may be used in fixing doors and blinds. Take a rod, and holding it against the edge of a door, mark off upon it where the hinges are to go, top and bottom. Then drive in the rod sharp pointed brads or nails at the marks, and it will then form an accurate gauge for all doors of the same size. Place it against the door with the top end even with top of door, give it a tap with the hand, and the exact position of hinges is marked, and the depth and distance back may then be gauged and chiseled out as usual. Instead of setting up the door to mark the position of the hinges on the door jamb, the rod is used for the purpose in the same way as before, only that a nail is driven in the top and allowed to project just sufficiently to allow for play of the door. By this method I have been able to hang 10 to 12 pairs of outside blinds, with mortise hinges, in a day.

L. E. Thornton.

Berwick, La.

AN OLD PIONEER BRIDGE.

When coming to Chillicothe, Ohio, on the Columbus pike, while still a mile or so north of the city, the traveler catches sight of what appears to be a huge, weather-worn barn directly ahead; but on coming nearer, it changes to a covered bridge, spanning the Scioto River, just on the outskirts of the city.

This is one of the pioneer bridges west of the Allegheniès, having been built in 1817, and is now nearly 70 years old.

During this time it has sustained less repairs than is usually the case with wooden bridges, and, with the exception of the bents under the north span, is in nearly the same shape as when erected.

It was built as a toll bridge by a company of the then citizens of Chillicothe, but few, if any, of whom live to see the structure replaced.

After being used for some time as a toll bridge, it passed into the hands of the Columbus & Chillicothe Toll Pike Co., and last winter was, with the pikes of the county, bought by the county commissioners, who will replace it with an iron bridge the coming month.

As near as can be learned, the building was superintended by a man named Fox, who is said to have built the first bridge over the Schuylkill, in Pennsylvania.

The bridge is of three spans of about one hundred and fifty feet each, making a total length of 450 feet.

It spans the river from north to south bank.

The two south spans are built on the same plan as the half span shown in elevation, while the north span is a trussed arch, stiffened by a trussed span bolted to it.

The bridge is double roadway, and each span is formed of three trusses, with cross bracing, most of which is supported by brackets.

The arches are made of ten layers of oak, 10 × 2 inches, which are spiked together break joint, and bolted through every five feet.

The verticals are 10 × 10, and chord or tie beam 10 × 24 inches. Though having done duty for nearly three-quarters of a century, the timber in the arch seems sound, while the chord is nearly rotted in two in many places from dry rot.

The suspending rods are of 1½ inch square forged iron, with heads forged on, but keyed at bottom instead of threads and nut.

Most of the timber joints are mortise and tenon, being strapped with iron, which is spiked to the timber, there being very few bolts in the bridge.

The timber for the bridge was hewn from the surrounding forest and whip-sawed into shape.

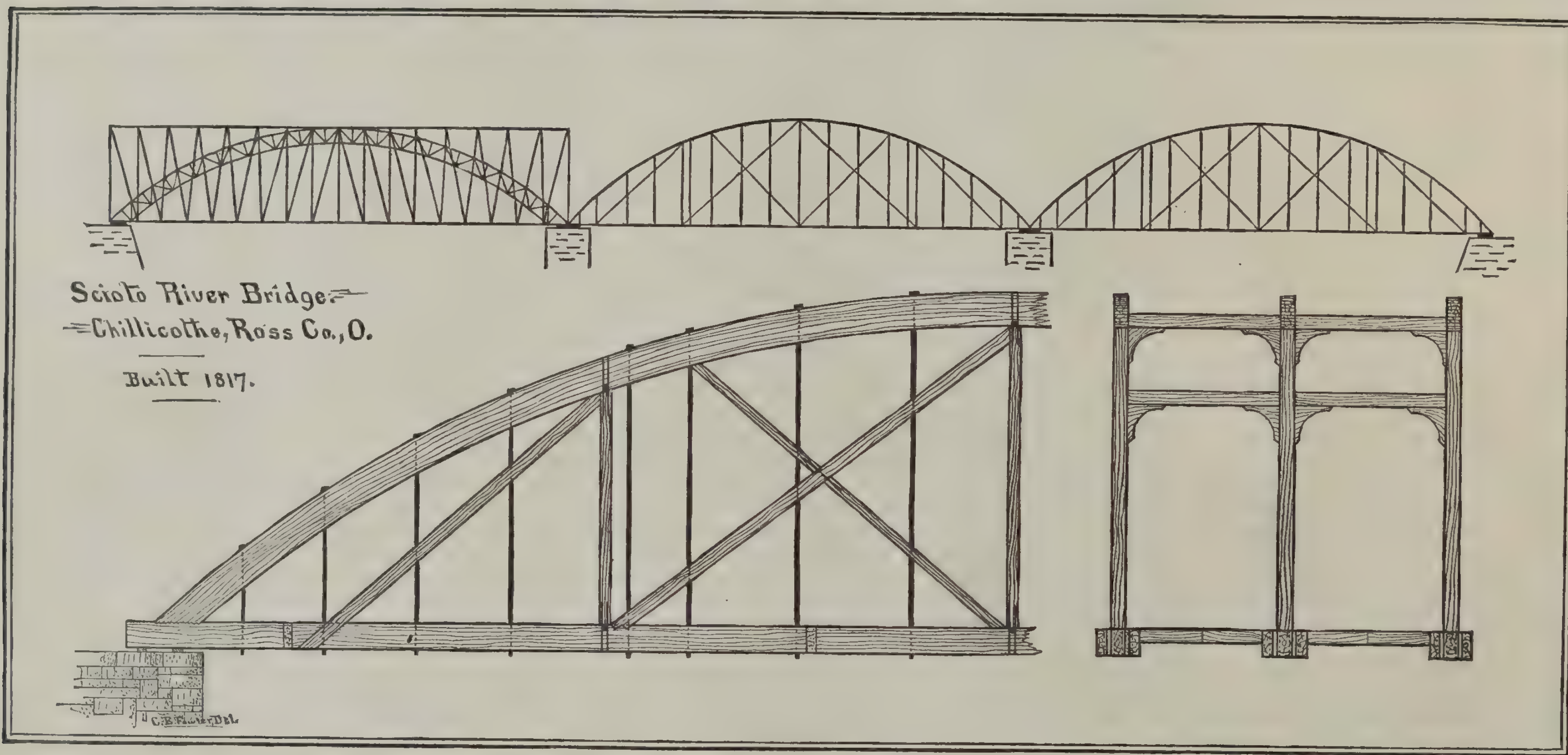
The iron for the suspending rods and straps was forged, so an old resident informed me, by the Juniata Iron Works, of Pittsburg, and carried to destination by pack horses and wagons. The bridge is covered by housing, which extends the entire length and gives it its barn-like appearance.

The substructure, piers, and abutments are of sandstone, smooth dressed rubble work, and are made with very little or no batter.

They all seem to have stood the washings of the treacherous Scioto, except the south pier, which is in bad condition near the base.

While many places can boast of old and curious structures and feats of engineering, I think Chillicothe, the old capital, and one of the oldest towns in Ohio, can boast of one which, while being somewhat of a curiosity, deserves mention as showing the thorough and painstaking manner in which the fathers of engineering in this country performed their work.

The bridge during the past few months has been lighted by Brush electric arc lamps; and here, on the banks of the famed Scioto, the old bridge and the electric light have joined the hands of the early work of the nineteenth century with the modern triumphs of science and invention.



AN OLD PIONEER BRIDGE.

Lumber Estimates.

The time occupied in figuring out estimates for lumber is very great, and the checking of the items on the statements is so long a process as to often necessitate the employment of a special clerk for that duty in firms dealing largely with the lumberman. Mr. Frank W. Thaxter, of Diana, Dak., has just copyrighted a form of statement and estimate which will prove of very great value to builders, contractors, and lumbermen. The number of feet in board and other standard measures, in lumber of various scantlings, is printed upon the form, with blank columns on the right for cost and totals, which can be filled out in a very short time, with the printed figures as guides. Spaces below on the form are provided for cull boards, fencing, mouldings, and various other items of the timber merchant, and add much to the completeness of the form, which will doubtless be quite extensively used when it becomes well known.

Natural Gas in the Blast Furnace.

Reports from Pittsburg state that an experiment was recently tried at the Isabella furnaces as a preliminary movement toward introducing natural gas into blast furnaces. One per cent of the supply of coke was cut off, and the ore and limestone immediately showed signs of chilling. Coke serves not only the purpose of furnishing heat in a blast furnace, but by reason of its great strength it supports and keeps loose the other ingredients, so that the blast has free action. Experimenters fear natural gas can never be used in the place of coke.

REMOVAL OF A CHURCH.

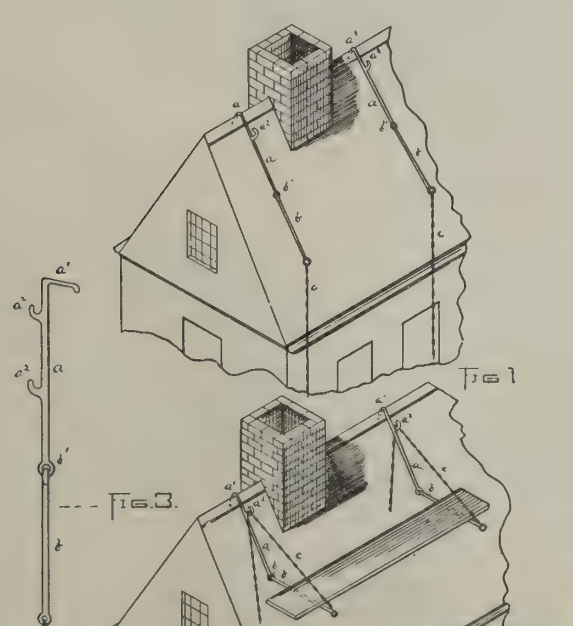
At Wallsend, Grey Valley, New Zealand, the church known as St. Saviour's, which was erected in 1878, was lately removed from the crest of the hill upon which it stood to a more convenient position, near to the main road, as indicated by dotted lines on the accompanying sketch. The building is 42 feet long by 23 feet wide. A track about 220 feet long was made by forming the slope of one uniform inclination of about 30 degrees with the horizon. Four skids, 44 ft. long, 9 in. × 10 in., were bolted longitudinally to the sleeper joists. Before lifting the building off the piles the interior was well braced, the porch was removed, and the windows taken out. It was then lifted off the

REMOVAL OF A CHURCH.

piles and brought down by five men, with the aid of two 20-ton hydraulic jacks and other tackle. The calculated weight, including the new work in lengthening the walls 2 feet 6 inches, was 18½ tons. The additional height of walling was erected on the new site, and the church placed upon this. It was thought that the increased height might necessitate buttresses, and the following calculations to ascertain the stability under wind pressure were made by the architect. The pressure of wind on one side at 50 pounds per square foot=54,000 pounds in round numbers. The center of gravity being 7·5 feet from the floor, the moment of pressure tending to overthrow the building = 7·5 × 54,000=405,000 pounds. Weight required to prevent overturning should = ½ base × weight = moment of pressure. This gave 11·5 feet × 35·217 pounds, the latter quantity being equal to 15·7 tons against 18·5 tons, showing 2·8 tons of dead weight to prevent overturning. The building was relined after removal, and the total cost was $672. Mr. G. W. Fraser did the work, under the superintendence of Mr. E. Pentelow, the architect.

NEW SCAFFOLD BRACKET.

By William H. Hughes, of Washington Mills, N. Y. —Each bracket is formed of two pieces jointed or hinged together, as shown, with the upper sections of the bracket provided with hook or angle bends for



SCAFFOLD BRACKET.

engaging the peak of the roof or any other suitable support for securing the same to the building. On the opposite side of the hook or bend, and in near proximity thereto, I provide one or more projecting hooks on each section of the bracket for engaging the connecting coupling, which is attached to the extremes of the jointed sections, whereby said sections may be moved to the desired angle and retained by the connection being hooked over the hooks, ready for receiving the floor of the scaffolding, which may be discharged from the jointed sections by unhooking the connection from the hooks and allowing the same to drop, and by means of the joint the same may be folded into a compact space for convenience in storing and shipping.

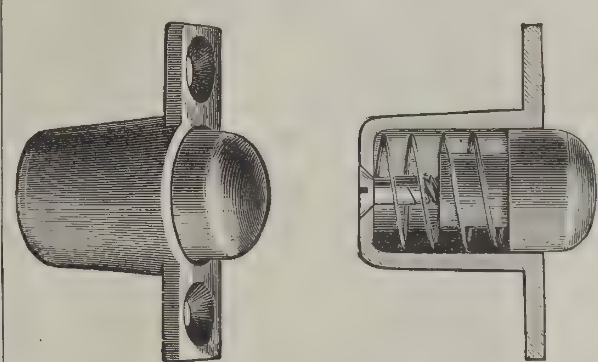
The brackets may be removed and folded into a compact space for convenience in storing and shipping.

A Railway Along Niagara Falls.

Travelers at Niagara Falls will recall the difficulties in the way of visiting the points of picturesque interest along the rapids below the Falls, terminating at the whirlpool, about 2½ miles distant. The river rushes between precipitous bluffs about 200 feet in height, and access to these places is obtained by descending at various points by means of elevators or stairways. The rivalry of those controlling these various descents has added to the physical difficulties in the matter, and there is no good footpath along the river at this part. A railroad has been chartered to be built along the base of the bluff on the eastern side and near to the river, so as to afford passengers a continuous view of the rapids and of the whirlpool. There is a slope of detritus which will serve as a foundation for the construction of a railway as near to the water as safety will permit. The gauge of the road will be either 30-inch or 42-inch, and the cars arranged with seats facing the river, and the alignment of the road arranged with the purpose of affording as nearly a continuous view of the wild and romantic scenery as possible; there will be no tunnels, and only one open cutting, which will not extend over 100 feet. It is seriously contemplated to use electricity furnished by the Falls as a motive power; but if no practicable plan for an electric railway be found, then a cable railway will be used, the power in this case being also derived from the Falls.

A CONVENIENT SASH-HOLDER.

The little device known as Ayer's patent sash-holder, which we have shown in our illustrations, will be found



AYER'S PATENT SASH-HOLDER.

very convenient for a number of purposes. It is intended to hold a window sash in any desired position, and to prevent the disagreeable rattling which is an almost invariable accompaniment of windy weather, in even the best constructed casements. The small cast-iron casing, or shell, is inserted in the sash, two on each side. The button or holder is pressed outward by the spring against the sides of the frame, and thus holds the sash in place by friction, while, at the same time, it effectually prevents any rattling. The construction of the device is very simple and substantial, and its durability is stated to much exceed that of the sash-weights and cords generally used for this purpose. The button is composed of a compound having a slight rubber-like flexibility which gives it an excellent hold upon the side of the frame, but does not mar the paint. The holder is readily applied by making a small auger hole in the side of the sash, and when in place is entirely out of sight. It is equally applicable to the sashes of windows, to sliding blinds, or mosquito netting frames in either house, car, or carriage. The device received the medal of excellence at the American Institute Fair in 1885.

Another convenient little device is shown in Fig. 3. It is Ayer's Novelty Sash-Holder and Anti-Rattler, which is intended for pretty much the same purposes as the larger holder, except that its extreme simplicity and small size make it available for a number of additional uses.

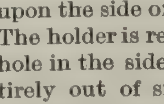


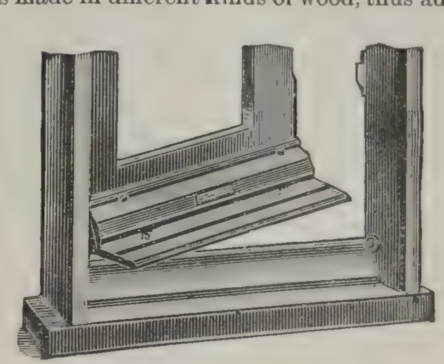
Fig. 3.

It is simply a button of the same rubber-like material, and mounted loosely on the end of a screw. When used on a window, it is attached to the side of the frame with the edge of the button pressing against the sash. It thus prevents all rattling, and by pressing the sash back against the frame it also performs in a measure the service of a weather strip. The device may also be used to advantage on the back of chairs or other furniture, to prevent marring the wall, on door stops, and elsewhere.

Both of these holders are manufactured by the Ayer's Patent Sash-Holder Company, corner of Broadway and Chambers Street, New York.

THE "PERFECTION" WEATHER STRIP.

This engraving represents an automatic weather strip, intended to prevent the entrance of currents of cold air under the outside doors of dwellings, and also to prevent the rain from driving up during the violent storms of summer. It is known as the "Perfection" Weather Strip, and is manufactured by the Richmond Weather Strip Co., Richmond, Ind. The device is arranged in two sections, so connected that as the door is opened the strip is released from its confined position against the sill, and is raised high enough to pass freely over the sill or the carpet that may be inside the room. On shutting the door, the strip is forced down in position by coming into contact with the knob or stud shown in the right of the frame, near the floor. The strip is made in different kinds of wood, thus adapting



THE "PERFECTION" WEATHER STRIP.

it for use with all kinds of finish. Among the special qualities to which manufacturers direct attention may be mentioned that it is constructed *without springs, triggers*, or *circular irons*, and has a positive action. It is counterbalanced in such a way as to produce the results above named. A modified form of this device is made adapted for use on double doors. Both styles are so constructed as to be readily fitted in place by carpenters and mechanics in general. The strip is adapted to the width of the door by cutting from the ends, for which purpose ample surplus wood is always allowed.

Sheet Metal Construction.

Architects and builders who deem it necessary to keep up with the march of events should give full consideration to the growing art of sheet metal construction. There is certainly ten times more sheet metal used in building now than ten years ago, and its uses are only fairly initiated, many new ones being devised yearly, prominent among which we mention fire-proof corrugated iron arches for ceilings; tastefully painted small-sized corrugations for interior decorations of public halls, theaters, offices and stores, and also for various other uses adapted for particular cases only; these in addition to the well known and practically tested use of iron for roofing and siding.

We have the "Wire Age;" may there not be a Sheet Metal Cycle?

Perhaps the greatest single cause of the rapid increase in these uses of sheet metal has been the ably directed energy of the always advancing and thoroughly reliable Cincinnati Corrugating Co., of Cincinnati, Ohio, whose "literature" we would recommend to the perusal of all interested in building.

FASTENER FOR WINDOW STOP BEADS.

This simple cheap, and effective fastener is designed to permit of adjusting the stop beads of windows to the sash. Fig. 1 is a view of the stop bead, and Fig. 2 is a cross section of the stop bead and casing with the fastener applied. It will be seen that the stop bead may be adjusted so as to prevent all rattling or binding of the sash, and so as to keep out the cold and dust. These fasteners may be applied with advantage to sliding door and other casings, and to houses already built which have windows in which the

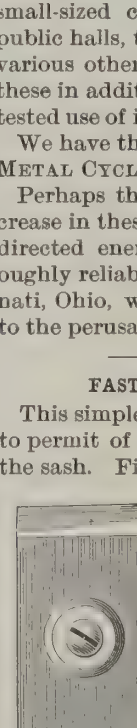


Fig. 1

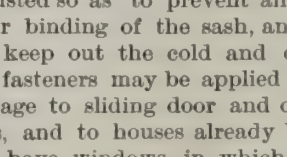


Fig. 2.

sash either rattles or binds. The sole manufacturer of these fasteners is Mr. C. R. Nelson, 108 Liberty Street, New York City.

Marking Ink.—Reimann gives the following recipe for a marking ink: 1·1 pts. nitrate of silver, 2·3 pts. spirit of ammonia, 2·2 pts. soda, 5 pts. gum arabic, 0·2 pt. sapgreen, 2 or 3 pts. distilled water. After marking, apply a hot flat-iron until the tracing is perfectly black.

THE MINNEAPOLIS LIBRARY.

We present a perspective elevation of the Public Library, Minneapolis, Minn., a noble structure, massive in design and execution. It reflects credit upon the architects, Messrs Long and Kees, and is a worthy monument to the intelligence and enterprise of the citizens of Minneapolis. We are indebted to the *N. W. Architect* for our illustration.

Criticism of Light American Carriages.

Carriages usually termed light work are all of American origin in style, workmanship, and finish; and the builders of this country endeavor to bring their work to a finer stage of perfection each season. It is very entertaining to the American builder to listen to the criticisms of foreigners in relation to light carriages, particularly those who first inspect our work, even by some whom we should have supposed to be better informed in their construction. When a buggy is first seen on the streets by a foreigner, he at once wonders why such a rig does not break down, and it seems to him almost an utter impossibility to sustain the weight of two men. The Frenchman calls them spiders on account of their fragile appearance, while the Englishman designates them boxes on stilts.

If foreign builders would examine and study our carriages, they would find that it takes much more science to build our light work than it does to build the heavier grades. We make our light work with the lightest possible dimensions for the intended weight to be carried, consequently any imperfections in the body or gear will appear at once. The principal criticism is in regard to comfort, some even supposing we have no other style of vehicle outside of the buggy to ride in. It is, of course, almost incredible that such views can exist, but our personal intercourse with foreigners proves that they are much less informed as to our methods of building than we are with theirs. As, for instance, take a buggy or surrey body as we make them; an English or French body-builder could not give it the neatness and precision, he not possessing the necessary judgment and practical knowledge.

Our body-makers understand how to make perfect work with astonishing rapidity. Suppose we take a buggy body carrying but one person; the panels are but $\frac{1}{4}$ inch scant on top, and only $\frac{5}{16}$ full at the bottom. The bottom sides are only $\frac{7}{8}$ inch thick by $1\frac{1}{4}$ inches deep when suspended on side bars. The bench under the seat is only $\frac{9}{16}$ inch thick. The seat and rails when with sticks are $\frac{9}{16}$ inch, and the sticks $\frac{1}{4}$ inch wide by $\frac{3}{16}$ inch thick. Having but $\frac{3}{8}$ inch square tenon for the end pillars, bottom tenons, the mortises in the seat frame, of course inclined from both sides, fit together as though they had grown that way. This is also true with square or turned spindles. The carriage or gear parts, including the axle beds, perches, head blocks, and bars, are finished in a very tasty manner from the best hickory that can be found.

With the smith it is the same as with the body-maker. When a foreign blacksmith has been accustomed to iron heavy carriages, it takes him a long time to acquire the knowledge and ability to iron a buggy properly. This is also true with the trimmer. Now, as to comfort, we design and build our carriages for different purposes; if we ride in a buggy, we do not expect the same comfort that we would in a landau or coach. Those who buy and ride in buggies know for what purpose they are to be used; and if they did not possess all the comfort to be expected, they would not purchase the same. Buggies are built for both pleasure and business uses; if for pleasure and fast driving, it must be very light and strong, and comfort is a secondary consideration, as the driver usually sits erect in driving, not even using the back cushion. The satisfaction derived is in the lightness and elasticity of the carriage, which enables the covering of great distances. The business buggy is built on the same principles, but the peculiar feature of the business for which it is to be used is taken into consideration.

Our phaetons, vehicles carrying but two persons, with or without tops, are built very compact, the space between the wheels being from five to six inches, with one elliptic spring front and either one or two back, connected by a perch. The bodies, as made by American builders, are as comfortable as a cabriolet or victoria; they ride very easy, and on account of being very elastic, make it better for the horse; the only fault is the compactness, but if the builder made them as long as a victoria, they would not be salable. Now, as regards the heavy work built for comfort and pleasure only, the average American builder can not only combine comfort with perfect construction, but also display beauty in the outlines and perfection in finish. The majority of heavy styles are of English and French origin, but the builders of this country have so improved their style and finish that they are now much superior to those built across the waters.—*The Carriage Monthly.*

THE PUBLIC LIBRARY, MINNEAPOLIS, MINN.—LONG & KEES, ARCHITECTS.

"Saltpetering" in Stone.

The actions capable of affecting the stability of the composition of ordinary building stones, by reason of the new forms of matter they superinduce, may principally be considered to be those resulting from the absorption of the gases of the atmosphere, and especially the extraordinary process known by the name of "saltpetering," or more correctly speaking, of nitrification. This process displays itself in the formation of minute crystals efflorescing from the interior to the exterior of the stone, and it leads to the destruction of the exposed surfaces of the latter, through the gradual removal of the minute particles, in consequence of the disintegration produced by an expansive action of the crystals in process of formation. It is supposed that the organic matter diffused through nearly all stratified deposits gives rise to the formation of certain nitrates (such as the nitrate of lime or the nitrate of soda) under the influence of damp and of air, and of light of certain descriptions—for nitrification certainly takes place most abundantly near damp ground, rising in a wall *pari passu* with the range of the capillary attractions of its materials, and upon the northern or shaded faces of the said walls. Not only does this nitrification throw off the minuter and less adherent particles of the building materials themselves, whether they be stone or brick, but it is also able to detach any protecting coat which may be put upon them, if the adhesion of that coat to the subjacent material should not be of a very energetic nature. Let the adhesion, however, be ever so energetic, if once the action of nitrification should have been established, it must run its course, and the amount of evil it is capable of producing will simply depend upon the quantity of organic matter originally contained in the materials or susceptible of being absorbed by them from the atmosphere. The secondary limestones which have not been affected by plutonic action, the loamy clays, some kinds of pit sand, sea sand, and some descriptions of natural cements, are particularly exposed to the danger of nitrification in damp positions; and wherever it is once established, it is in vain to expect to be able to preserve any mural paintings, or even any sculpture of a delicate character. It is also to be remarked that nitrification will frequently take place in the most dangerous manner precisely in those materials whose exposed surfaces are covered with coatings impervious to the air; and that in houses or buildings of that character it is most energetic on the interior faces of the walls, or precisely on those which are the least exposed to the atmosphere. In fact, it is mainly in consequence of the absorption of moisture by the building materials, and of the chemical changes thus produced in the organic matter those materials may contain, that the peculiar form of decay which accompanies "saltpetering" arises. G. R. Burnell.

A Fast Chinese Torpedo Boat.

A new torpedo boat for the Chinese Government has recently left the wharf of Mr. Schichau, of Elbing, under steam for Canton, China. This boat is 144 ft. 4 in. long, has 16 ft. 5 in. beam, and 7 ft. $6\frac{1}{2}$ in. draught. It is fitted with triple expansion engines of the Schichau type, and capable of indicating 1,500 horse power. On the trial trip, run, as in all boats built at these works, in the open Baltic, the registered speed was 24·23 knots (about 28 miles) for one hour's duration, the boat being fully equipped, and carrying coals for 1,000 knots on board. The mean speed on a two hours' run under similar conditions was 23·9 knots. On another run made with completely filled bunkers, coal for 3,000 miles, an average speed was maintained during four hours of 22·5 knots. This torpedo boat is being steamed *via* the Suez Canal to China, with a crew on board consisting of captain, mate, three engineers, four stokers, and six sailors, and special provisions have been made to make the cabin accommodation as convenient as possible for the hot climate.

A HOME COSTING ABOUT $1,200

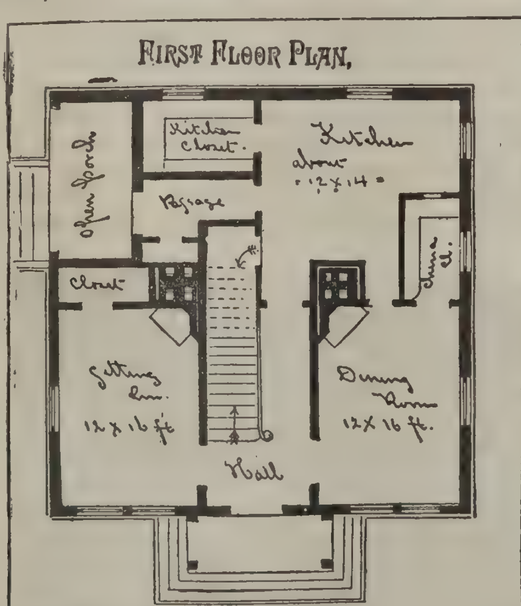
No good mechanic, it matters not how humble his calling or lowly his sphere of usefulness, but, if he be a true man, aspires to a home of his own, and where he may at the close of a hard day's work take that comfort and rest that comes only to a contented and satisfied mind. And it would indeed be strange, in this era of liberal education and advanced ideas, with books, lectures, and beautiful art objects within the reach of every intellectual mind, however light the purse, if he did not aspire to something a little better than the conventional every-day house of four walls and a pitched roof; if he did not look with pleasure, and a laudable desire to emulate his example, on the pretty little vine-covered house, with its neat and tasty garden, of some neighbor or comrade of no more liberal income than his own, and forthwith resolve to go and do likewise.

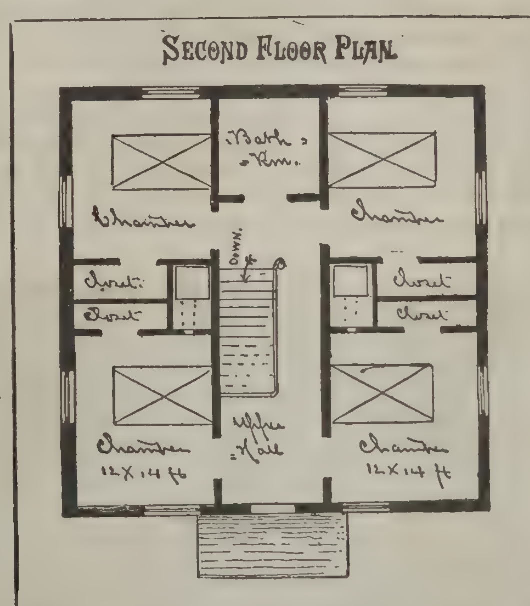
The plan here offered—a house of seven rooms, three down stairs and four chambers above, costing about $1,200—was designed to meet such a want, being neat and picturesque, and at the same time simple and convenient—advanced in ideas, without being ornate or obtrusive. A square house without breaks is the most economical of plans, and capable of being added to as the increase of family or income may demand. Our plan allows a central hallway of liberal size, with dining-room and sitting-room on either side. Back of the dining-room we find a liberal sized although somewhat irregularly shaped kitchen, out of which leads the back parlor, cellar stairs, and a generous kitchen pantry. We cannot be too careful in the situation and arrangement of this part of the house, especially when the burden of the work falls on the shoulders of the housewife. Here she passes the greater part of her day, attending to the cares and comforts of the family; and if everything be pleasant, handy, and roomy, the routine of family duties and cares may become much lighter and more agreeable, if not a source of real pleasure.

Up stairs are four good-sized chambers, each with its attached closet, and capable of direct connection with the chimneys, which is very desirable, both for health and comfort. In the upper hallway, room has been found for a large closet, the usefulness of which we need not explain to the frugal housewife. If desired, the dining-room may also be used for a living room, and the room opposite as a family chamber or nursery. Both rooms can be heated by open fireplaces of simple style for burning hard coal, or by the more commonly used stoves. Care has been taken to preserve the housewife's ideal luxury—plenty of closet room—as the plans will show.

The estimate calls for foundation walls of broken stone, laid in cement mortar, said walls to be 16 in. thick, leaving 2 ft. of neatly pointed surface exposed. The chimneys are started with the foundation walls, and arranged to have four continuous flues to the top. All doors are four-paneled mill doors. Outside doors, 1¾ in. thick; inside, 1⅛ in. Side walls and ceilings lathed and well plastered; "one coat" work well smoothed down; no finishing coat, but the walls may have one good coat of sizing and water-color of any desired tint. All woodwork of pine, painted two good coats. Abestos paint is highly recommended as wearing well and having a gloss in itself that will stand washing.

The lower hall may be of black walnut; 3 in. octagon newel; a 2 by 4 in. moulded hand-rail, and 1¾ in. turned baluster coming within the appropriation. The principal framework should be well put together with mortise and tenon; rafters and studding 16 in. on centers; studding may be cut in lengths to fit and well nailed in place. The floor should be thoroughly dried, close laid, and double nailed to each beam with tenpenny nails. All sashes are 1½ in. thick, and set with second quality French glass; hung with iron weights. Good 18 in. pine shingles will do for roof and cornice belt to be laid 6 in. to the weather. In the cornice belt they may be laid "broken jointed" for prettiness of effect. An air space is allowed in top of roof, ventilating to open air, and protected by lower boards at the openings. This will freely ventilate the upper chambers, which otherwise would be close and stifling. This house being steady and sober in character should be painted in quiet, sober color, viz., the body a soft brown color with a yellowish cast. Do not use too much white lead, as this will give a chalky look. The trimmings, blinds, and doors should be of a darker, russet brown. The cornice belt may be a golden brown, or even a rich, deep yellow, and all roof two good coats of red. The first coat may be Brandon (this is very cheap and covers well); finish over this with asbestos or Indian red; the latter is a little expensive, but wears extremely well. The under surfaces of the porch and piazza, if painted creamy yellow (one part medium chrome, two parts white), will reflect an agreeable light into the adjoining rooms. It is a fact that does not seem to be commonly known that this color reflects more light than the pure white, and the commonly used "sky blue" reflects but very little light, and that of a very trying quality to the eyes. The appropriation allows for a priming and one good coat of lead and oil color.





A $1,200 HOME.

A little care given to the house and grounds, and a little money spent on improving or adding to them, as it can be spared from year to year, will soon make as pretty and comfortable a home for a family of small means and tastes as could be desired. It all depends on the inmates of such a home whether—like good wine—it improves with age; or, on the other hand, from carelessness and indifference, it is allowed to run to rack, ruin, and weeds, which, we are sorry to say, is often the case, as too many homes in country and suburbs will testify.—*Mechanical News.*

How to Make Roads Pleasant.

The very name of the adjective umbrageous conveys to the mind immediately a picture of beauty and delight; how natural to associate, in this connection, balmy air freighted with the dewy fragrance of sweet-scented leaves and blossoms, hum of bees, and the music of the countless warblers, as we have them all in May and June! These and much more are absent from the treeless road. The beauty of a road is in the trees that should fringe each side, and the larger they are, the greater the adornment. What lover of the beauties of nature—or one with human feelings—is not enchanted, and his thoughts elevated, by a drive or walk under fine old trees?

The enemies of shade for the highways say that it keeps the roadbed damp, and prevents drying. That is what we need on all sandy roads, and it is incontrovertibly true that damp sand is preferable to dry for the pedestrian as well as for the traveler in a conveyance, though clayey spots are made worse by it. I am a champion for shade along the public roads, and would like a continuous line of fine trees on both sides of every public road in the country; if of eatable nuts or fruits, so much the better for all concerned, especially the poor townsfolk who own no land, and find it such a treat to take a ramble in the country; besides, it would be an inducement to keep them from trespassing in the fall after nuts, which is a terrible annoyance to all land owners near the cities. Let them have the fruit or nuts that fall on or hang over the roadbeds free, with a penalty for marring, to prevent all climbing for nuts, and to require the careful gathering of other fruit (that requires picking from the tree) without injuring the branches; that is, that all fruit grown on the public roads be public property.

The rapid destruction of forests is stripping our land of its lungs—though counterbalanced by cultivated crops as inhalers and exhalers—as well as its robes of beauty; so if we can save a strip along the highways, it will do much toward retaining the beauty and health of the country. The mere cutting down of timber trees does not destroy a forest unless they are conifers (cone bearers); all other trees quickly reproduce themselves by suckers; so if the land is not grubbed and cleared, the forest will be denser and finer than before, in say from 40 to 50 years. Chestnuts and locust attain a fine size in 10 years. Pines (and I think without exception the whole pine family) are totally killed when their trunks are severed near the ground, and can only reproduce themselves from seed. Second-growth chestnuts (and I suppose it is also true with others whose reproduction is similar) are far superior timber, both as to durability and straighter grain, than that of the first growth; that is, suckers that spring from a stump of a first growth are very much better than where a single trunk rises from a seed. Indiscriminate destruction of valuable shade trees on the public roads should have the condemnation of the entire country. . . .

One of the necessities of the age is a book with the most essential common laws briefed, and with all ambiguities and foreign terms erased, or, if necessary, replaced by small synonymous English words, so that the average child of twelve years can comprehend them, with a chapter or two upon proper behavior while either riding or walking upon public highways; true civility to the traveling public; how to pass vehicles; correct side upon which the driver should sit; what right the gunner has to shoot upon the public roads, water, and government property; a plain discrimination between public and private property, and common rights well defined, etc. Such a book should be furnished every public school in the land, to be a text-book for every day.—*Country Gentleman.*

Slow Combustion.

Spontaneous combustion is said to be an impossibility, but a phenomenon that at one time would be ascribed to that cause has lately been observed in the suburbs of Paris. In 1871 a fire occurred in a villa. The reparation was carried out under the direction of an architect, and the house has since been occupied by the same owner. One day he observed that the ceiling of the dining room appeared as if some of the plaster was about to give way, and, as the bulging increased, he called in an architect. He concluded that a beam must somehow have given way, and workmen were employed to make a more close examination. It was then discovered that the wood was almost entirely consumed. Some sparks may have remained, and during fifteen years the destruction must have gone on by inches, for no other hypothesis was brought forward than one of very slow combustion. The circumstance is so remarkable as to appear almost incredible.

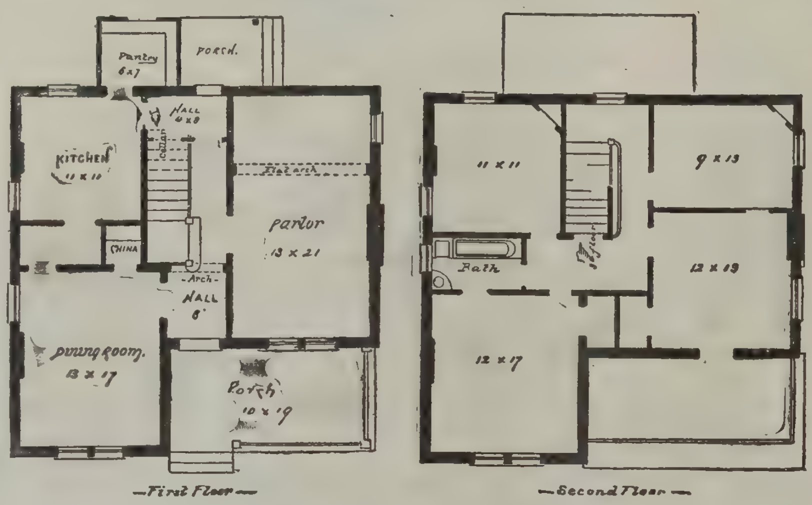
DESIGN FOR COTTAGE.

To design a neat, cheap, convenient, and roomy cottage is no easy task. The man who, ten years ago, would have been satisfied with a plain square house has become educated in architecture, and we see the result on all sides in the picturesque homes that dot the landscape.

The illustration given herewith needs but little explanation. The hall is wide, and extends from the front door to the back part of the building. The stairs are located in such a position that a back flight is almost unnecessary, being convenient to the back entry and kitchen. The parlor on the right is quite large for a dwelling of this description, and opens into the hall by wide folding doors. The dining room on the left has a large china closet, and connects with the kitchen through a closet or lobby with two doors, thereby shutting off any disagreeable or offensive odors from the kitchen.

The second story has four good sized bedrooms, closets, bath-room, etc. The outside speaks for itself. The upper porch over the front door, covered by the projection of the main roof, is a novel feature, and the general outlines of the roof itself, while quite plain and cheaply constructed, give a pleasing effect to the whole. The house can be built complete for about $3,400.

Culver & Rodgers are the architects, 901 Walnut St, Philadelphia.—*Sanitary News.*



DESIGN FOR COTTAGE.

Tree Growth.

Hon. R. W. Phipps, Forestry Commissioner for Ontario, has been, for several months, devoting his time to visiting the principal fruit-tree nurseries and estates, where attention is given to arboriculture for timber and fuel. In a recent letter from Southern Kansas to the Toronto *Globe*, he writes:

"One railway board here, knowing that the growing of wood, when set about in earnest, is neither a slow nor difficult task, has established in Kansas the largest artificial plantation of forest trees in North America. These railway gentlemen themselves gave out the contract for planting over a square mile of land with young saplings of the catalpa and ailantus; and their president, observing the success of their experiment, and impressed with its probable excellent financial results, has had planted at his own expense as a speculation as much more. These are situated near the little town of Farlington, Kan.

"These plantations, now bare of leaves, stretch far over the undulating prairie, in full view of the town. The different sections have been planted, it appears, respectively two, four, and six years ago. About one-fourth is planted with the ailantus, the rest with the catalpa, and a few, perhaps a thousand trees, of white ash. Those first planted are now about 25 ft. in height, the last about 12. Some of the taller are 7 in. through the stem. The first seedlings were brought from Illinois by the car load—the rest grown in seed beds here. There are in all about three million of trees in full growing vigor on these plantations, this calculation leaving out a few on some small portions of poor land, which are not flourishing so well, but will be good trees in time.

"All were planted 4 ft. apart each way to shade the ground, but 8 ft. is the ultimate intention, which will allow three-fourths of the trees to be cut out, a thing which can well be done when they are fit for fence posts, say 7 to 9 in. through; or, if required, they can stay even longer without injuring the plantation. When rather larger, it is expected the trees will make excellent railway ties, and at their fuller growth of 15 or 20 years they will supply very valuable timber for cabinet work and house building.

"Those who have only seen the original forest, with its trees growing at haphazard here and there, little ones and big, have but a very vague idea of the large amount of wood the closely planted groves can spare in their process of growth. This process, partly natural, is also, by the art of the planter, rendered partly mechanical. Extensive masses of young trees planted in this manner are restricted to but one method of advancement—the endeavor to throw out masses of leaves to the light and air of the upper surface. The lower branches, hidden in shade, rapidly die and fall to the ground, and the plantation becomes a multitude of long, straight stems, full of life and vigor, but only spreading into branch and foliage at the summit. If a tree in youth be crooked it straightens itself, if thus surrounded, as it advances in height. One acre so growing will give of wood, which is all the better taken, quite a number of cords yearly till all the superfluous trees are gone. On each acre here there are 2,000 more trees planted than will ultimately be allowed to attain full growth. There will be left, perhaps, 900,000 to come to maturity, and as these, as well as being very useful timber, are fast growing trees, the profits seem likely to be very large."

THE MEXICAN ORANGE FLOWER (CHOISYA TERNATA).—From a Photograph.

To polish nickel-plated goods after becoming black and not worn: Use rouge on a rag with a little oil.

Slowly Combustible Buildings.

The following circular, issued by the Boston Fire Underwriters' Union, states the requirements of safe construction clearly and concisely. Mills, factories, stores, warehouses, and other buildings used for similar purposes, constructed in accordance with the following instructions, will be slowly combustible, and will receive the lowest rating: Walls to be of brick; of such thickness as the intended occupancy and building laws of the city may require; and not exceed sixty feet in height from the sidewalk. The inner surface to be left plain or plastered direct on the brickwork; cornices to be of brick; roof to be flat and of "mill construction" (*i. e.*, made of heavy timbers and planking, without plastering or sheathing), and covered with gravel or metal. No wooden Mansard or French roofs allowed, as they are regarded as "lumber yards up out of reach of water," furnishing so much additional material for the fire to feed on, as well as greatly increasing the risk of fire from adjoining property; girders and columns to be made out of the best Southern pine timber. Iron girders and columns not allowed; floors to be made of "mill construction," consisting of heavy Southern pine timbers from five to ten feet apart, according to the burden they are expected to carry; covered with three-inch tongued and grooved plank; then two layers of asbestos or other heavy floor paper (in stores or warehouses an inch of lime mortar can be used instead), and then an inch flooring above. These floor timbers and floors to be left exposed beneath, without plastering or sheathing; elevators and stairways to be in brick well-holes extending at least two feet above the roof and crowned with a skylight having an iron frame and thin glass protected with an iron screen. All openings on the various floors to be protected with standard tin-clad fire doors, or in outside towers cut off by standard fire doors; well-holes for light not allowed in this class of buildings; shutters to be placed upon all windows and other openings at the rear side of the building, when exposed by other property, or by another section of the same property cut off by division brick walls. To be of standard construction, and the fastenings so arranged that they can be opened from the outside; blind attics and other concealed places that cannot be readily reached by firemen, not allowed; boilers for heating or power to be placed in separate buildings or fire-proof rooms, and provided with regular boiler chimneys.

MEXICAN ORANGE FLOWER.

This noble shrub, with its wealth of clusters of orange-like bloom, yields a bountiful supply of flowers for cutting. The glossy foliage, of great substance, forms a rich setting to the solid white petals and pale gold-colored anthers. The engraving of a handful of flowering sprays loosely arranged in a glass bowl shows its value as a cut flower, and also the good effect of one distinct flower arranged simply by itself with its own foliage.—*The Garden.*

Scarlet Fever Communicated by Clothing.

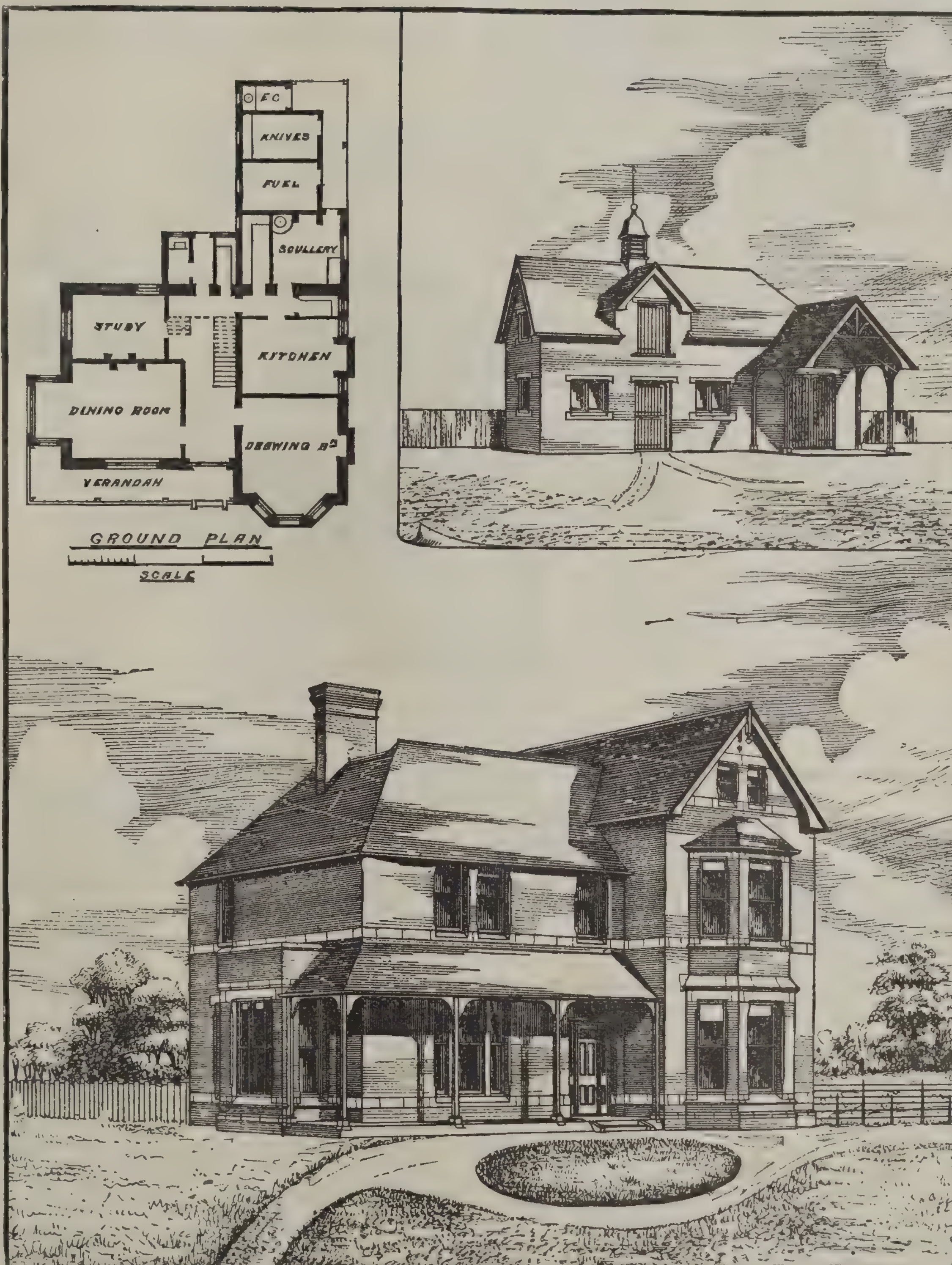
Another case showing the communicability of contagious diseases by clothing is reported from Bath, Maine, where a girl had scarlet fever at boarding school. After recovery she returned home, and a trunk containing the clothing she wore while sick was put away in the garret. Six months later, two little children were playing in the garret, and, opening the trunk, took out some of the clothing. In a week both were taken very ill with the disease, and one died. There were no other persons ill with scarlet fever in the community. The danger of contagion being communicated in this manner is particularly great with scarlet fever, the virus being present in the scales that peel off from every part of the body. For this reason, clothing worn during convalescence may be more dangerous than that worn during the height of the disease. —*Annals of Hygiene.*

A COUNTRY RESIDENCE AND CARRIAGE HOUSE.

The residence illustrated in the engraving, and known as "Hillside," has lately been erected at Clacton, Essex County, England, for R. Rees, Esq., from the designs of Mr. A. Broad, architect, of Croydon. The external walls of both the residence and stabling are built with a cavity, the face being the best red kiln-burnt bricks. A brown stone, known as Monks Park, is used for the sills, window and door heads, and trimming, the piazza or veranda is constructed in pine, and the roofs of both buildings are covered with slates of the dark green variety.

The design, for which we are indebted to the *Building Times*, has a neat and substantial appearance in elevation, although the plan seems to be open to improvement. The small perspective sketch of the carriage house is very compact and pleasing, and as such will probably prove useful and suggestive to our readers.

The cost of building such a residence in this country, under ordinary circumstances, would be about $7,520, this sum not to include the carriage house.



HILLSIDE, CLACTON, ESSEX.
For R. REES, Esq.
Mr. A. Broad, *Architect*, Croydon.

Lavatories.

In bath tubs, perhaps the most important and luxurious of our sanitary appliances, too great precaution cannot be taken to guard against the dangers of using those having a lining or composed of any material that will in any way oxidize, exude or absorb contaminating or poisonous substances, whether of the vegetable, mineral, or animal kingdom. Such materials should not be used.

The extent of the bad effects and dangers of bathing in tubs of such nature can, in the absence of thorough scientific research and investigation, only be a matter of conjecture, but to the average intellect it must be apparent that there exist possibilities of a most startling nature.

It is possible that we have never seriously thought of this subject before, or given it that consideration which has been bestowed upon other agencies of death and disease. We have attributed to the cesspool numerous cases of typhoid fever; to the sewer and catch-basin, diphtheria and other diseases; to the lack of ventilation we lay the prevalence of pulmonary ailments. Against all of these, sanitary laws have been passed for protection, but the skin, with its millions of ducts leading into our bodies blood and cutaneous diseases which baffle the cleverest skill of the medical profession, has been left to protect itself.

No law directs us what to bathe in, but laws have been enacted in some of our communities providing the manner of supplying the water we drink and in which we bathe. These laws provide that direct supplies to the water-closet are dangerous, and many other wise measures with which the reader is no doubt familiar.

The bath tub, if made of copper, can exude its bibasic acetate, commonly known as verdigris, which, under the softening influence of hot water, readily blends with and impregnates the fluid, to be conducted by the feeders of the skin into the body. Lead and zinc tubs contribute those oxides, which are soluble in water, and those who have seen the baneful effects of lead poisoning know too well the horrors of that disease.

Our lead works employ men at high pay in the dusting room, whose stay there means slow death, sooner or later, by the absorption of this impalpable powder through the skin.

Now, again, the tubs of copper, tin, lead, zinc, or wood soon become dull, tarnished, or foul, and a film spreads over them which can carry germs of animal disease which the last afflicted bather has thrown off; and if a body in perfect health, and free from disease of a similar nature, be immersed in the warm water of such an infected tub, what must be the result with the floodgates of our skin wide open?

Disease, especially of an infectious or contagious nature, does not come to attack us in the form of large, visible, cyclonic bodies from which we can flee to a place of security. How infinitesimally small must be the particles or germs of disease that are wafted on the air or carried in the clothing from the sick chamber! An infected rag may bring cholera in our midst to destroy thousands.

What damage can be done by the bath tub—who can tell?

Clean and scour them! We do, but we cannot keep them bright and clean. The housemaid does not and cannot clean in the sharp corners; the brush will not reach there always.

The last bather, we all know, never does and never will clean it as he steps from the tub at a time when it can easily be done before the scum has dried. What can be the remedy as far as lies within our power?

Resort to the use of such materials as we know are least liable to such conditions. We turn to the nearest in perfection, namely, the porcelain-lined, iron or enameled fireclay tubs with rounded corners, where germs cannot collect or filth breed them. They are clean, sweet, and smooth as glass (which in reality they are); perfectly non-absorbent; the acids of the body or the alkaloids of the soaps cannot possibly affect them; and as for their oxidizing or exuding harmful substances, it is simply impossible.

Glass surfaces and porcelain enamels, when properly applied, are as enduring as the hills. There is nothing to give out or absorb; they even resist that most penetrating of all fluids—electricity.—*Sanitary News.*

Hydrogen gas has the lowest conducting power of the gases; lead the lowest conducting power among the metals; asbestos the lowest conducting power of minerals; and cotton is probably the lowest conductor among vegetables.

Defective Roofs.

Neglect of roofs is a prime cause of decay in dwellings. A writer in the London *Builder* declares that our roofing, as a rule, is probably in a more primitive condition than any part of our buildings. If we compare the water-tight and durable protection of the ancient leaden roofing to the shelter given by either tiles or slate, we shall see at once how much of the absolute water-proof efficiency of the building is sacrificed to effect a money saving, which, of course, is a very considerable item. Neither tiles nor slates are laid so as to be absolutely water-tight. They lap over each other, so that in no part of the roof is there, or ought to be, less than two thicknesses of slate, or an unbroken thickness of tile. And so long as rain falls vertically, or nearly so, it will run from edge to surface of tile after tile, or slate after slate, and make its way to the gutter without entering the roof. But the case is altered if we have anything of such weather as is frequent in more southern latitudes. If a swirling wind accompany a heavy rainfall, it will often carry a stream of water up over a portion of a roof. Snow at times makes its way upward, by the aid of drifting wind, into tiled roofs. Stucco, plaster and rough cast are highly favorable to the retention of damp and to the progress of decay. Or, again, they may admit of a gentle percolation of water between the wall and its jacket, which has the same effect. The use of bricks made of certain clays—among which the gault has an evil prominence—is also conducive to damp.

If any repair is required in a roof, and the workmen are allowed to walk over the roof, unprotected by planks or ladders, the chances are in favor of their making two leaks while they stop one. The mere weight of the man, if allowed to come directly on a tile or slate, will very likely crack it. Again, a nail or peg left out, not to say a pick of a slater's hammer, is quite enough to lead to the sagging of the roof, and to the general increase of damp and advance of decay.

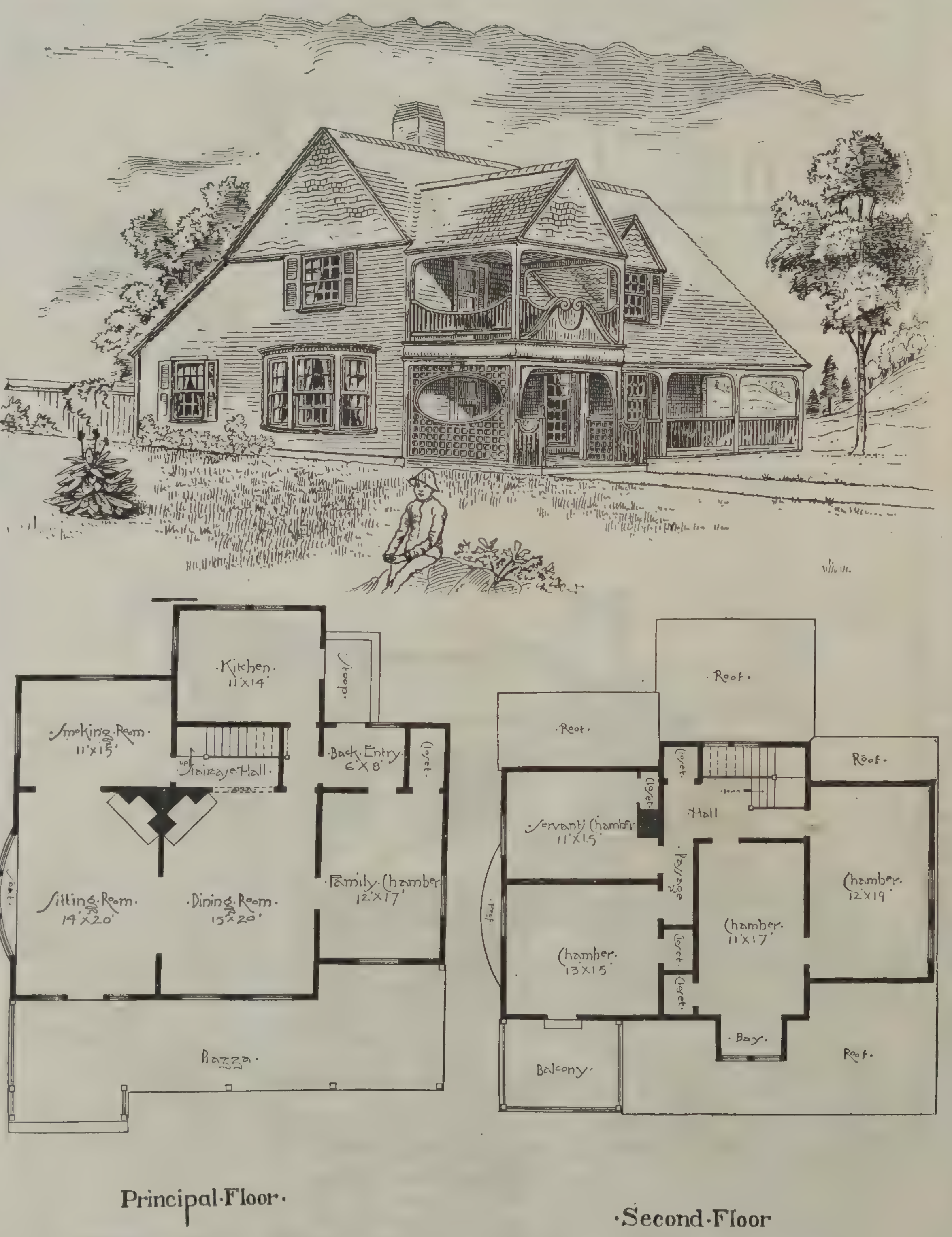
Early English Doorways.

An early English doorway is often a wonderful piece of art, however little it may attract the attention of ordinary observers. It is most pleasing to notice the long trails of dog-teeth lurking in the dark furrow of a label or channeled recess; to see the end of some inconvenient member got rid of by throwing a flower across the point where it suddenly stops or dies into the wall; to admire the efflorescent boss and the foliaged capital intruding their luxuriance upon the mouldings and hollows, as if they had overgrown their original and proper limits. How beautifully, too, the knots of pierced and hanging leaves extend like some petrified garland or bower of filigree work round the arch, dividing the plainer mouldings into groups, and almost imparting life to the very stones. There are abundance of doorways of this style which exhibit the most delightful varieties in their forms and groupings; always yet never the same. Some examples occur at Bolton and Furness Abbeys, whose arch mouldings extend five or six feet in width. The west fronts of several of the cathedrals have early English doorways of amazing magnificence. Alas, that we should now try to borrow an unreal splendor by "running" archways by the yard in vile terra-cotta or viler patent cement! And strange that, with such noble examples of rich perspective effect and artistic display before them, our architects will generally persist in inventing mouldings for themselves rather than copy any of the perfect works of ancient art which are everywhere to be met with, and of all degrees of costliness. The wretchedness of modern mouldings can only be appreciated by those who take the pains to compare them with the ancient.

F. A. Paley.

DESIGN FOR A COTTAGE.

We illustrate another of the "Artistic Homes" of Mr. Albert W. Fuller, architect, of Albany, N. Y., taken by permission from his work bearing that title. The design is an attractive one from the very simple and artistic manner in which it is treated. The plan is arranged to give ample accommodation for a house of this description, and the whole building is designed to permit of its execution at a moderate cost. Carried out with simple details, in white pine, the estimate of the architect is $2,000.



DESIGN FOR A $2,000 COTTAGE.—ALBERT W. FULLER, ARCHITECT.

Stable Floors.

The floor is the most important part of the stable, for it has much to do with the safety of the horses' feet, and we know that "if there is no foot there is no horse." It is usually the weakest and worst part of the stable, being subject to the most wear, and is generally so saturated with filth as to be seriously injurious to the health of the horses kept on it.

For reasons that are obvious, a stable floor should be durable, not too hard or unyielding, impervious to moisture or vermin, adherent to the feet and not slippery; smooth and nonconductor of heat. The selection of material for all these qualities is by no means easy, and the best materials that can be used require certain methods of use or adaptation before they can be made to meet the majority of these requirements. Wood is the most common material in use, and its cheapness, ease of working, and nonconducting property go a great way to make up for its want of durability. But there are several kinds of wood, and some are better than others for this purpose. The hardest woods are not the most durable. Three-inch bass-wood plank has made a more durable stable floor than one of three-inch white oak plank, and it was warmer, softer, and gave a far better footing, because it wore shreddy instead of smoothly, as the harder oak did. This timber has many useful points about it, as it will stand rough usage and wear for such purposes as wagon and cart bottoms and floors of barns and stables, when these are well ventilated underneath, better than any other. Hemlock and spruce come next in this respect. But a plank floor is an absorbent of the urine, and soon becomes rank with ammoniacal odors. Then some process is required to make the planks water-proof. This may be done by saturating them with hot gas tar, when the floor becomes a most desirable one for such stables as cannot have a ground floor. For a plank floor of the best kind I would lay the timber double; that is, first a floor of three-inch plank of some soft kind, and thoroughly soak this with boiling hot gas tar, filling the joints well. Then while the tar is still hot and soft a two-inch plank floor is laid, breaking joints and pressing the planks close, so that the tar fills the joints of the upper floor and overflows upon the upper surface, which is finally well coated with tar. This floor is made to slope to the rear one inch in the yard, two and one-half inches in the seven and one-half foot of the standing floor, which is all that is double. This short double floor gives a dry bed for the horses, and the drainage all flows off from it to the lower floor, where it may be collected by a liberal coating of dry absorbents. The tar coating is apt to make a slippery surface, but this may be avoided by dusting dry sand upon the tar until no more will be taken up. Some years' experience of such floors for horse and cow stables and pig pens has proved them to be very desirable for buildings which are raised from the ground or over manure cellars; and, as a rule, all farm buildings should have the floors cleared of the ground at least for eighteen inches, or have ground floors as a precaution against the harboring of vermin.

Ground floors of stables may be made in a variety of ways. The best are no doubt made of concrete, of broken stone, gravel and gas tar, mixed and laid down hot, and of wood blocks laid on end and saturated with hot tar. The former is an exceedingly durable and solid floor, non-absorbent, non-conducting of heat, and therefore warm for the animals, cool for the feet, and wholly impenetrable by rats. The method of laying this floor is as follows: A sheet-iron pan is procured and set upon loose brick or stone supports. A fire is made under it, and the gravel, screened to the size of peas and beans, mixed with coarser broken stone or gravel, is heated and then thrown into a heap. Melted hot gas tar is poured over the heap, and the mass is shoveled over until it is thoroughly mixed. The operation goes on in this way while the mixed concrete is laid down on the graded floor, previously covered with coarse gravel thoroughly rammed down and leveled. The concrete is laid down three inches thick, and is raked even and rammed down firmly. The ramming forces some of the tar to the surface. This is covered with coarse sand screened from the gravel, and is raked over with a steel garden rake and made smooth and beaten firmly. This is repeated until there is an excess of sand on the surface, which is swept off, when the whole work is finished and hard. Any gutters or drains that may be needed are moulded in the floor as it is laid. This floor is the best possible for a carriage house, barn, granary, or any other farm building, as well as a stable.

Where timber is abundant and gravel scarce, a floor of blocks set on end is but little inferior in durability to that of concrete. Chestnut timber makes a very lasting floor and absorbs a great deal of the tar, which prevents decay. This floor is laid in the following manner: The surface is properly graded, and covered with one-inch hemlock boards for a foundation. These boards are coated thickly with hot gas tar. Blocks eight inches thick are sawed from a sound chestnut tree of even thickness across the grain. These are split into smaller blocks, as nearly square as possible, and laid on end on the tarred boards and fitted closely together. After the whole floor is laid it is covered with coal ashes, sand, or any kind of fine mineral, which is swept into the crevices so as to fill them to the surface. This filling should be tamped as firmly as possible. The floor is then drenched with hot gas tar, which is swept with a coarse brush or broom into the spaces between the blocks, so as to saturate the filling and fill them solidly. Care should be taken to get these interstices well filled up. The surface is dusted over while the tar is soft with some absorbing material. Any little unevenness in the surface is advantageous rather than objectionable, as it gives a secure footing for the horses. The board foundation is necessary, as it prevents the blocks from sinking under the weight and wear upon them, and thus disturbing the level of the floor.

These floors are by no means expensive, and when their convenience, usefulness, healthfulness, and long service are considered, they are really the cheapest of any in the end.—*Country Gentleman.*

Germs in Water.

The close connection which often exists between drinking water and the contagion of various diseases is unfortunately too well known to call for fresh announcement. A multitude of plans for purifying household water prove its general recognition. In all these the directing principle aims at the exclusion of organic matter, the source of chemical changes which nourish the omnipresent elements of infection. With regard to morbific germs themselves, it is more than doubtful if any system of filtration can directly destroy or exclude them. It is true that they may be killed by oxygenation, but the power or duration of this process in domestic filtration can seldom, if ever, be relied upon for the purpose. Yet filters form an effectual check to disease the germs of which are conveyed by water. The object still chiefly to be aimed at is, therefore, to starve out these injurious atoms by removing their organic pabulum. In reasoning thus, however, we imply that disease germs will only develop in water containing organic material, and not in that which is free from it; nor are we without experimental evidence in support of this view. Among investigations into this subject the most recent is that carried out by Messrs. Crookes, Tidy, and Odling on various London waters. Small quantities of culture fluid containing bacillus anthracis were introduced into household waters of different mineral composition, but free alike from organic impurity. In each case the germ remained active for a short time, until probably its food supply was used up, and the water was infective when added to a sterilized culture medium. After a few hours it lost this property. Thus it appears to be proved that bacillus anthracis, at all events, does not flourish in pure water, and we may probably regard it as being in this respect a test example of the behavior of other morbid germs. These facts are encouraging, since they show that a wholesome water supply is possible even for the poorest, filter or none, if that in the mains is good and the domestic cistern is uncontaminated by dust or sewer air.—*Lancet.*

Every person requires, at least, from 3 to 5 cubic feet of air per minute. Ordinary windows allow only about 8 cubic feet a minute to pass, and hence the necessity of providing a distinct inlet and outlet for the air in all apartments, thereby promoting a proper system of ventilation. In hospitals this rate must be materially increased.

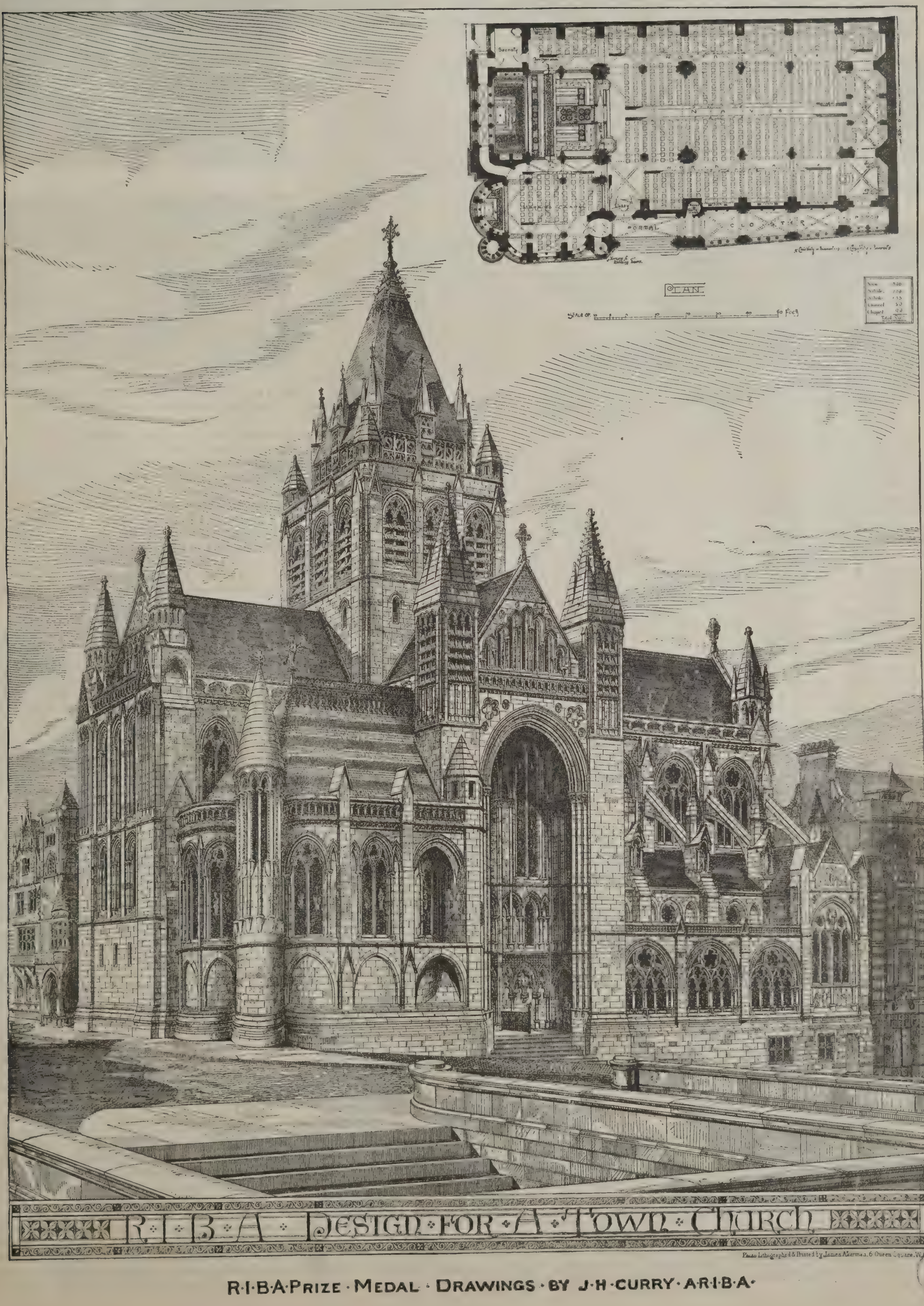
PRIZE MEDAL DESIGN FOR A TOWN CHURCH.

This prize design is the one over which a considerable discussion was held at a recent meeting of the Royal Institute of British Architects, the President, Mr. Ewan Christian, Prof. Kerr, and others contending that particularly for the ability of its plan its author should be awarded the Soane Medallion, for which his design was submitted in the late competition. In this opinion we still concur, and we have much pleasure in illustrating the general view and plan. The Institute awarded a medal to Mr. J. H. Curry, A. R. I B. A., for this design and the drawings with which it was illustrated.—*Building News.*

Medicated Raisins.

Some genius in England has taken advantage of the aversion of children to taking medicine, to obtain a patent for medicated raisins in four different ways—namely, as an aperient, vermifuge, cough remedy, and digestive. These are simply large raisins impregnated with the medicine in a highly concentrated form, and covered with an aromatized sirup dried. A better way, perhaps, to prepare these would be to dissolve the active medicinal principles in raspberry ether, and to inject the raisin with an accurate dose of this ether with a fine hypodermic syringe.

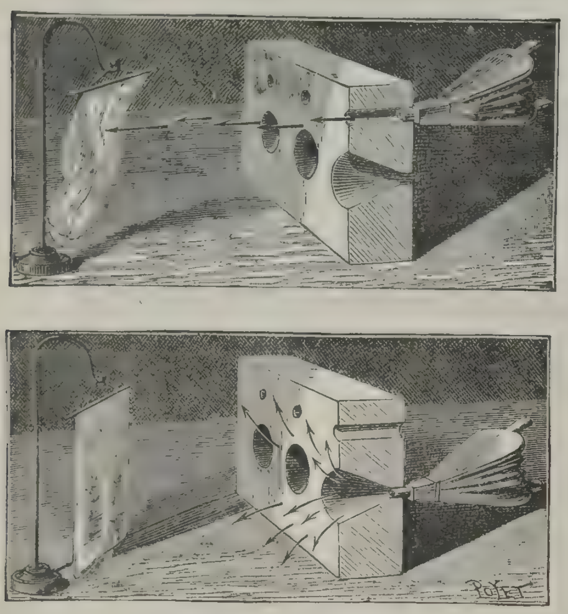
IT is estimated that the wine crop of California will reach 25,000,000 gallons this year.



R·I·B·A·PRIZE·MEDAL·DRAWINGS·BY J·H·CURRY·A·R·I·B·A·

ON THE AIRING AND LIGHTING OF HOUSES.

One of the greatest dangers against which man should provide in his dwelling is the confining of the air that he must breathe. It is not enough that the air that surrounds our dwellings be salubrious, but it is especially necessary that the internal air be not contaminated by any mephitic odors, and that we may breathe therein as in the open air. So the fundamental conditions that are necessary in order to have a healthy habitation may be summed up as follows: (1) that of having fresh air to breathe amid walls and furniture kept at a proper temperature; (2) that of receiving the full light of the sun, and of having the objects about ourselves amply lighted; and (3) that of having no dejections remain in the house.



Figs. 1 and 2.—EFFECTS OF AIR BLOWN THROUGH CYLINDRICAL AND CONICAL APERTURES.

Such conditions, hygienists have at all times endeavored to realize, but, in measure as human habitations have become more numerous and more closely packed, builders have the more and more neglected them. And yet, the proper sanitation of a house is the best means of warding off epidemics and all contagious diseases; for the example of all epidemic manifestations shows that it is in unhealthy towns, and in quarters that contain the foulest habitations, that these almost exclusively develop and spread. The great epidemics of past ages obtained their innumerable victims in those heaps of houses accumulated around the ramparts or under the churches and castles of our old cities. At present, it is under the same conditions that such scourges as cholera, typhoid fever, smallpox, and others make the most ravages; and these ravages they will continue to make until we succeed in improving such dwellings. Doctors Fodor and Rozsahegyi, after recently examining the houses of Buda-Pesth, from this point of view, have published the following results.

Out of every 100 houses the mortality was found to be

	Very clean houses.	Clean houses.	Dirty houses.	Infected houses.
Cholera	2	199	268	402
Typhoid fever	175	177	182	356

On another hand, there has been registered, per 10,000 inhabitants and for 15 years, the following mortality for the same city:

	Very clean houses.	Very dirty houses.
Cholera	90	430
Typhoid fever	162	515

Is not the cleanness of a house, moreover, connected with the conditions of hygiene that it presents?

Among the conditions that we have enumerated above, there are two to which we would now more particularly call the attention of our readers. The Exposition of City Hygiene, now open at the Loban barracks, back of the City Hall, furnishes the occasion to show various processes that have been devised in recent times for the sanitation of towns and dwellings; and the moment seems to be well chosen, then, for making known the principal arrangements.

As regards the airing of houses and apartments, it is obvious that an endeavor should be made to continuously introduce into the latter as much air as possible from the exterior, such air, whatever be the situation, being much more wholesome than that confined within doors. As for the evacuation of the air, that is effected through the chimneys and numerous apertures that our apartments are provided with. In a number of connected houses, it is effected through special apertures. Now, in each inhabited room it is the window that puts us most thoroughly in connection with the surrounding atmosphere; but although the panes of glass that close this let in an abundance of light (an indispensable condition for salubrity), their impermeability is such as to prove an obstacle to the entrance of air. So, in the various cases where there has been need of introducing air into inhabited rooms in such a way as not to incommode people, methods of all kinds have been tried to obviate the said impermeability. Hence the placing of casements at the upper part of windows, and hence, too, that innumerable variety of Venetian blinds with strips of glass, mica valves, opercula, etc. In England, where much attention has been paid to this subject for a certain number of years, an infinite number of all sorts of processes have been devised; but it was soon found out that these caused currents of air of more or less strength, that struck the heads of those occupying the rooms thus aired. Then the idea occurred to place ventilating bricks, provided with conical apertures, at the top of the walls, near the ceiling. The experiment shown in Figs. 1 and 2 explains the principle of this arrangement. When air is introduced by a bellows into a cylindrical conduit, a rectilinear current is produced which strikes in a direct line the objects placed in front of it, as shown in Fig. 1, where the little banner opposite the conduit is seen to be considerably disturbed. If, on the contrary, the bellows be introduced into a conical conduit having the same external orifice and a flaring internal one, the same quantity of air can be blown without causing the banner to budge, the air dispersing in all directions as soon as it emerges from the expanded mouth of the conduit (Fig. 2). The use of such bricks, however, is accompanied with some drawbacks. It is difficult to multiply them much in apartments; and, as it is not convenient to wash them, the conduits get full of dust, which easily contaminates the air as it enters. A few years ago the idea occurred to some one in Leeds to substitute for these bricks a sort of wooden cage placed before the windows, and containing quite a large number of small apertures connected with cylindrical glass conduits ending in small panes. This affair has an ugly appearance, and possesses the same inconveniences as those just mentioned.

Prof. Emil Trelat, of the Conservatory of Arts and Trades, has for a long time been teaching how advantageous it would be to have at the upper part of windows some panes of glass containing a large number of small apertures of conical section, in order to satisfy these important conditions of airing rooms. Messrs. Geneste & Herscher, on their side, being struck by these same advantages, endeavored to find some industrial process capable of furnishing glass so arranged.

The Messrs. Appert Bros., after numerous experiments, have finally succeeded in manufacturing perforated panes, such as shown in Fig. 5. The manufacture of such glass offers very great difficulties, as may be easily divined. We know, in fact, that, when we want to pierce a piece of glass in order to put finger-plates upon room doors, we have to use a steel rod, and pour turpentine upon the glass in order to renew the surfaces and render the biting of the steel easier. Sometimes we add oxalic acid, and even mashed onions. During this operation the plate is often broken.

Messrs. Appert, Geneste & Herscher's perforated panes contain 5,000 apertures per square meter. These apertures have a circular section of 3 mm. diameter, and are spaced 15 mm. from axis to axis. The glass is 3·5 mm. thick. Other panes, a little thicker, have 4 mm. apertures spaced 20 mm. from axis to axis. By special, patented processes, the Messrs Appert have succeeded in surmounting all the great difficulties that this industrial problem presented, and their perforated glass now stands as a very remarkable specimen of recent progress in the art of glass making.

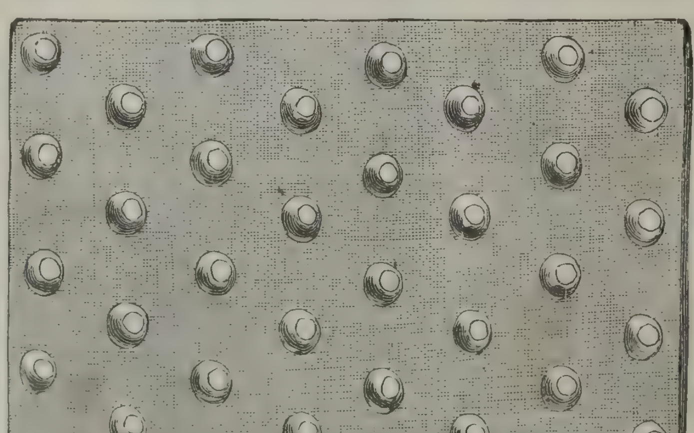


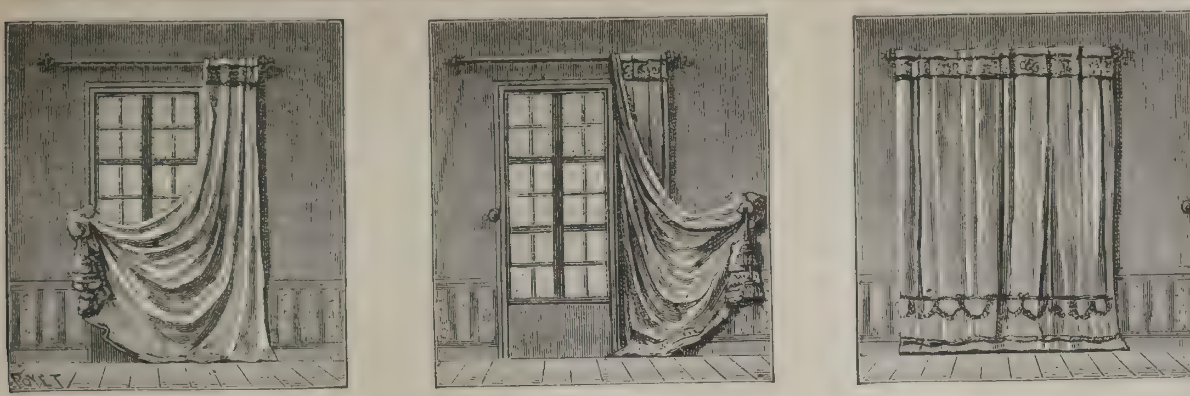
Fig. 5.—PERFORATED GLASS.

From the point of view that now specially occupies us, it must be remarked in the first place that these window panes have a surface of three square decimeters per square meter open to the external air.' Moreover, as the apertures open out in the interior, the currents of air expand upon entering the room. Prof. Trelat, to whom belongs the merit of having brought about the manufacture of this glass and of having shown its great value for airing dwellings, rightly recommends that it be not placed at less than 2·5 m. (8¼ ft.) above the ground, in order that the currents of air that enter shall not incommode the occupants; so that it is especially useful in all high rooms, and chiefly in apartment houses, school rooms, hospitals, dormitories, churches, and so forth. It has the advantage that it never becomes obstructed, since all the panes of the window are necessarily washed, and for this reason the air that traverses them does not become charged with any impurities. As the panes are made of translucent, not transparent, glass, they keep neighbors across the way from peering in. These perforated panes may likewise be profitably employed in rooms not so high and in our apartments, provided that they be so arranged that their open surface can be covered at times—this being easily done by means of a movable frame. Figs. 3 and 4 represent an easily reproduced experiment, by means of which is shown how this glass imperceptibly effects the airing of an inhabited room. If we blow in the direction of the small aperture toward the larger, the air will expand along the sides of the cone, and, on making its exit, will form a back-draught behind the candle opposite; while the candle will be at once extinguished if we blow in the opposite direction, the air in this case proceeding straight ahead and with force.

Figs. 3 and 4.—EFFECTS OF BLOWING AIR THROUGH A CONICAL APERTURE IN BOTH DIRECTIONS.

Prof. Trelat does not confine himself to professing that fresh air should be introduced, permanently and as much of it as possible, into living rooms, and that to this end it is well to provide the upper parts of windows with perforated glass; but also insists upon the necessity of introducing into rooms light that comes directly from the sky, at least during such times of the day as they are occupied. In fact, he has for a long time been the resolute partisan of a unilateral lighting of our school rooms, in which one of the sides of the room would contain broad glazed windows for giving light, and the other would contain bays for airing, to be opened only at night and during recess. As well known, artists accord peculiar qualities to lighting effected in this way. Prof. Trelat proposes to transform our usual internal arrangements, and make the upper part of windows entirely free. In one of the halls of the Exposition may be seen a window draped in this way by means of a rich curtain due to Mr. Penar, a skillful upholsterer. The light in this hall is certainly very agreeable, and of such a character as never to injure the most delicate sight, even after prolonged work in it. It remains to be seen whether fashion will adopt an arrangement for draperies whose elegance can certainly not be denied. However this may be, the question is put, and Prof. Trelat, whose proposed arrangements are shown in Fig. 6, will at least have done the service of pointing it out and solving it.

Prof. Trelat, whose models, made in conjunction with Mr. Gaston Trelat, are shown in Figs. 8 and 9, likewise insists upon the necessity of setting houses in different positions in northern and southern countries. It is well known how too much given we are to making everything uniform in our country. For example, we observe the same mode of construction adopted in our barracks at Dunkirk, Bayonne, Brest, and Toulon, just as if the climatic features were everywhere the same. Now, in order that the heating of the structure be equally distributed throughout all the materials, and that the rays of the sun may penetrate the rooms deeply, it is necessary that, in the north, the house shall be directed east and west, while, on the contrary, it should be north and south if it be desired in southern



GOOD LIGHT WITHOUT VIEW. LIGHT AND VIEW. NEITHER LIGHT NOR VIEW.

Fig. 6.—HOW A ROOM SHOULD BE LIGHTED.

lands to suppress the injurious action of the solar rays of the morning and evening.—*La Nature.*

Jarrah Wood.

Jarrah wood (*Eucalyptus marginata*) is a product of Western Australia, where it is found in considerable abundance. Mr. Thomas Laslett, Timber Inspector to the Admiralty, in his valuable work, "Timber and Timber Trees, Native and Foreign," says of it: "It is of straight growth and very large dimensions, but, unfortunately, is liable to early decay in the center. The sound trees, however, yield solid and useful timber of from 20 feet to 40 feet in length, by 11 inches to 24 inches square, while those with faulty centers furnish only indifferent squares of smaller sizes or pieces unequally sided, called flitches. The wood is red in color, hard, heavy, close in texture, slightly wavy in grain, and with occasionally enough figure to give it value for ornamental purposes; it works up quite smoothly, and takes a good polish. Cabinet makers may, therefore, readily employ it for furniture; but for architectural and other works, where great strength is needed, it should be used with caution, as the experiments prove it to be somewhat brittle in character. Some few years since a small supply of this wood was sent to the Woolwich Dockyard, with the view to test its quality and fitness for employment in shipbuilding; but the sample did not turn out well, owing to the want of proper care in the selection of the wood in the colony."

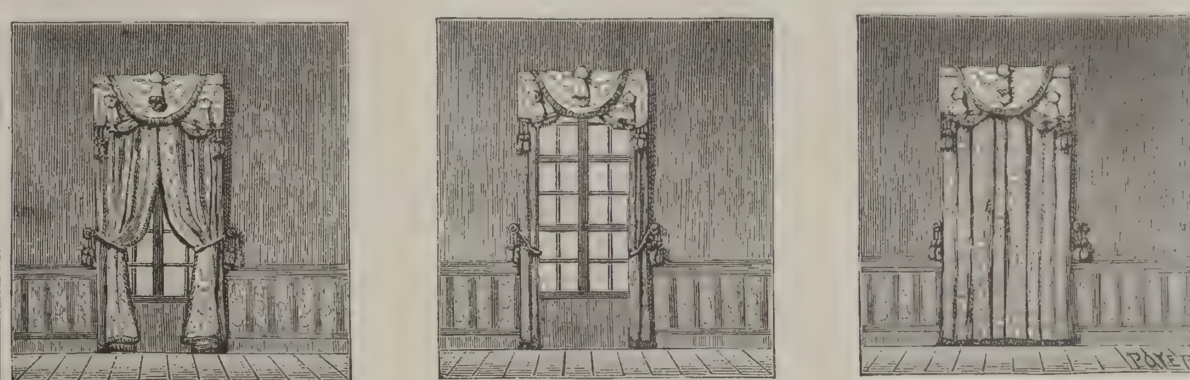
The clerk of works at Freemantle, in reporting upon the opinions expressed by shipbuilders and others, says: "The sound timber resists the attack of the *Teredo navalis* and white ant. On analysis by Professor Abel, it was found to contain a pungent acid that was destructive to life. The principle, however, was not found to be present in the unsound portions. Great care is therefore necessary in preparing the wood for use by flitching the log so as to cut all the defective portions of the heart out, and using only the perfectly sound timber."

Very much has been said about jarrah being subject to split when exported to England in log. It must be borne in mind that its density renders seasoning very slow, and that the inner portions of the larger trees are often in a state of decay, even while the outer portions are in full vigor. A tree under these conditions, the inner portions comparatively dry, and the outer full of sap, shipped at once to such a variable climate as that of England, very naturally bursts from unequal shrinkage, being also exposed to very great changes of temperature. To obviate this peculiarity and apparent defect, let the jarrah be fallen when the sap is at the lowest ebb, and carefully flitched, as previously suggested.

The methods adopted in seasoning jarrah are as follows: The logs are thrown into the sea and left there for a few weeks; they are then drawn up through the sand, and after being covered with seaweed a few inches deep, are left to lie on the beach, care being taken to prevent the sun getting at their ends. The logs are then left many months to season. When taken up they are cut into boards seven inches wide, and stacked so as to admit of a free circulation of air round them for five or six months before using them.

In a communication forwarded to India by H. E. Victor, Esq., C.E., of Perth, in reply to inquiries made by some gentlemen engaged in the carrying out of several large contracts for public works in India, he says: "Undoubted authority is unanimous in declaring that the timber of the jarrah, under certain conditions, is indestructible."

Professor Von Mueller, Government Botanical Director of Victoria, says: "Its wood is indestructible; is attacked neither by chelura, teredo, nor termites, and is therefore much sought after for jetties and other structures exposed to sea-water. Vessels built with this timber have been enabled to do away with all copper-



GOOD LIGHT WITHOUT VIEW. LIGHT AND VIEW. NEITHER LIGHT NOR VIEW.

Fig. 7.—HOW A ROOM SHOULD NOT BE LIGHTED.

plating. It is very strong, of a close grain, slightly oily and resinous in its nature, works well, takes a fine finish, and is, by shipbuilders in Melbourne, considered superior to oak, teak, or any other wood for their purpose."

The committee of Lloyd's, after the representations of His Excellency Governor Weld, determined to rank this timber with those in line 3, Table A, of the Society's rules; thus ranking it with *Cuba sabicu*, pencil cedar, etc., for the construction and classification of ships. The purposes to which jarrah may be applied are innumerable; it fills the place where saul and teak could not be admitted, as well as where they are used; and as the material can be supplied at a price considerably less than the timbers named, in the log, and at half their price in scantling, it should be employed where hitherto timber has been considered undesirable—for instance, in sea-facing, dock-lining, landing-stages, breakwaters, and beacons; curbs, road paving, block-flooring, weather-boarding, and wainscot partitions, wallings, ceilings, and roof coverings.

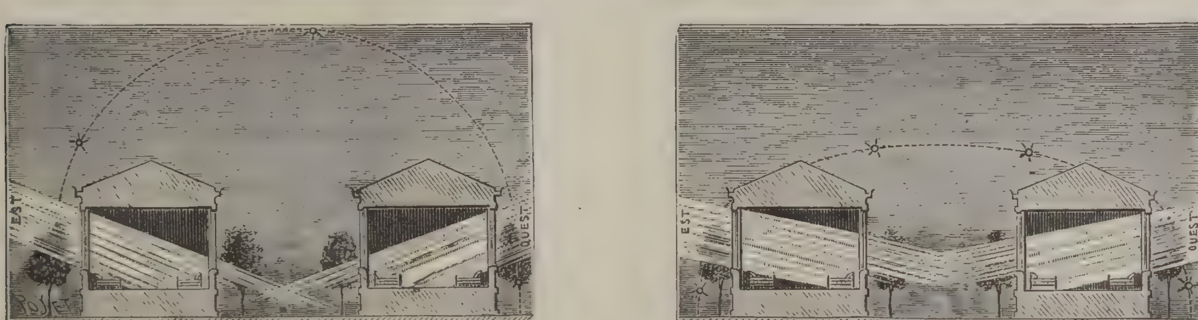


Fig. 8.—DIRECTION IN WHICH BUILDINGS SHOULD BE SET IN NORTHERN COUNTRIES.

A Western Australian almanac says: "None of the neighboring colonies possess timber of a similar character to the jarrah, or endowed with equally valuable properties. If cut at the proper season, when the sap has expended itself and the tree is at rest, it will be found the most end... his condition it defies deca... white ant, and the sea wor... speci-mens have been exhibit... had been nearly thirty yea... partly out. Others had been u... same period buried in sand, wher... troys in a few weeks every other kind ... peculiar property the jarrah is now muc... for railway sleepers and telegraph posts in... the colonies. It is admirably adapted for doc... piles, and other purposes, and for keel pieces, ... sons, and other heavy timber in shipbuilding. Vessel... of considerable burden are built entirely of this wood, the peculiar properties of which render copper-sheathing entirely unnecessary, although the sea worm is most abundant in these waters."

Though in the foregoing there are a diversity of opinions, yet the general tendency is to testify to the usefulness in an extraordinary degree, under stated conditions, of jarrah wood, and the practical mind will quickly see many opportunities for taking advantage of a wood possessing so many valuable qualities as this wood has been found to contain; and it is not saying too much to express a hope that the shipments now in the London docks will be but the prelude to many other, and more important, consignments to this country, where intrinsic merit is the only passport necessary to gain public favor and support where commercial interests are concerned.—*Building News.*

St. Sophia, Constantinople.

St. Sophia at Constantinople, of which at last authentic particulars have been obtained in the work of Salzenburg of Berlin, who, taking advantage of the scaffoldings erected by Fossati for the repair of the building, measured carefully every part of it. From this it appears that the diameter of the drum of the dome is 100 Prussian feet, or 102 feet 11 inches English, but the dome itself is 4 feet more, or 107 feet in diameter. It is constructed of forty ribs, projecting each 2 feet, which die away toward the center, leaving about one-third of the dome perfectly plain. The form is segmental, 45 feet 6 inches in height, and described consequently from a point about 8 feet below the springing. Round the base are forty windows, which throw in a flood of light; and altogether its appearance internally is as beautiful as any I know of. Originally, it was even flatter than it now is; but being in that form beyond the constructive power of its architect, it fell in, and the present form was adopted; but even then the architect tried to keep it as low as possible, judging correctly that the flatter it was the greater would be its apparent size, and also that of the floor it covered, and all of the parts around it. To obtain these internal advantages, however, the architect sacrificed the exterior entirely, and it is on the outside perhaps the ugliest dome ever constructed. But the same remark applies to the whole church. No pains whatever seem to have been taken with the exterior, though every part of the interior is designed with the greatest care, and ornamented with the most profuse liberality.—*J. Fergusson.*

Fig. 9.—DIRECTION IN WHICH BUILDINGS SHOULD BE SET IN SOUTHERN COUNTRIES.

Swiss carved work in whitewood affords excellent opportunities for hand-painting, and many pretty articles for home decoration can be made from it.

MORNINGSIDE PARK, NEW YORK CITY.

Naturally, one of the most picturesque and attractive portions of New York city is that bordering the Hudson River for a considerable distance south of the Harlem. Along the water front at Riverside Park—made famous as the final resting place of Grant—is a high bluff, beyond and to the east of which is a rolling, elevated country, plentifully covered with large trees. The high land abruptly terminates at Morningside Avenue, where a comparatively low and flat section commences. This level portion has been selected by the city to form Morningside Park, which will be, when the present plans of the Park Department shall have been fully carried out, a most pleasing pleasure ground.

The park is bounded by 123d Street on the north, by New and Ninth Avenues on the east, on the south is 110th Street, and on the west Morningside Avenue. Separating the park from the more elevated country is the wall that forms the subject of our illustration. Our artist, while faithfully depicting the general characteristics of the wall itself, has availed himself of that license for which artists, as well as poets, are cheerfully forgiven, and has slightly drawn upon his imagination for the pleasing features seen in the adjoining landscape.

The massive retaining wall was built by the Department of Public Works. Beginning at 110th Street, the wall is straight to a point near the northern extremity, where it curves, as shown in the center view, closely following the contour of the land to 123d Street. The wall is built of gneiss rock, obtained from the excavations. It has a batter of 1 in 12, and the face is broken ashlar. In some places it is over 20 feet thick at the bottom, and at the highest point, at 116th Street, it is 40 feet from the surface of the ground to the top, the foundation extending some distance below. The entire face of this wall will ultimately be covered with clinging plants.

Four bays and two entrances, which may be said to comprise the strictly ornamental branch of the work, combined, of course, with the useful, have been erected by the Department of Public Parks, whose jurisdiction may be said to begin at the face of the wall. There are two approaches to the main entrance or steps at 116th Street, shown in the upper view. The stairways measure 24½ ft. from out to out; the first platform is 22 ft. long by 7 ft. wide, and the other two are 15 ft. in length. The extreme width of the top, illustrated in the lower view, is 62 ft., and the front is broken by a large semicircular bay. The steps, coping, and caps of the columns are of granite, all the rest of the work being of gneiss. On top of the wall there will be placed stone columns and bronze railings.

The steps at 110th Street present similar features, as will be seen from the middle left hand view, and there will be like ones at 123d Street.

Located at 111th, 113th, 115th, and 117th Streets are four bays, semi-octagonal in form, and built in a style in keeping with the entrances. At the intervening streets it is expected to erect additional steps. The bays are designed to serve as outlooks and resting places from which the park may be viewed.

The tops of the bays are formed of iron channel beams resting upon the outer and inner walls, transverse partitions being erected in the larger entrances to support the ends of the beams. Between the beams are thrown brick arches, covered with asphalt. The chambers thus formed are entered through doors in the outer wall, and will be used for keeping tools, etc.

In this entire work no attempt has been made at profuse ornamentation; the whole is quiet, rich, and massive, and will be in harmony with the park upon one side and residences upon the other, and will form an appropriate division mark between the two.

The cost of the walls of the bays and entrances was $53,500; the steps, platforms, balustrades, and coping of the bays and entrances cost $75,000, making the total cost of the improvement as far as carried out about $250,000.

Improved Fire Extinguishing Apparatus.

A ... vel system of fire extinguishing has just been ir ... ed in London by Mr. William Glenister, chief
... nteer Fire Brigade, Hastings, and Mr. J. C.
... of London. The apparatus forms the
... nt. The new fire and life saving ma-
tricycle with which are embodied
... se reel carrying a large quan-
... ed hose for winding in a small
... nents for working on to a
... . A light double-pump
... apable of throwing
... by two pumpers.
... ropes and bag.
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Correspondence.

The Island of Malta.

To the Editor of the Scientific American:

In the May number of your Export Edition is a short article, in which it is stated that the island of Barbados, with an area of 166 square miles, contains a population of over 175,000 souls, that is to say, an average of 1,054 people to the square mile, and that therefore the Barbados is the most densely populated part of the earth.

Permit me to present the claims of this historic island of Malta for the peculiar honor of being even more densely populated than Barbados. The total extent of the land (or, more properly, rock), surface of Malta is about 95 square miles, and the proportion of the population (exclusive of the British war forces and of the visitors or non-residents) is, as near as can be estimated at this date, 1,500 to the square mile.

The city of Valetta contains the greatest plethora of population—its area being 0·318 of one square mile and its population 24,854, a proportion of 78,157 persons to the square mile. There is one specially populous quarter of Valetta known as the *Manderaggio*, whose area is 0·004 of a square mile, or 2·56 acres, wherein dwell 2,544 persons—a proportion of 636,000 souls to the square mile.

Excluding the one-third of the island which is unsuitable for cultivation, and the area occupied by buildings, and the population of Malta reaches the biggish number of 2,000 persons per square mile.

The island raises enough to support about one-third of its inhabitants. Nevertheless, the people are contented and fairly prosperous. There are no direct taxes levied of any kind, nor any insurance, for the buildings are absolutely fireproof; there is no fire department to support. The buildings are of the soft Malta stone, and the builder scarcely needs any other tools than a hatchet and a square, for the material is worked almost as easily as cheese. The island has no debt; *per contra*, it has upward of £250,000 invested in English funds. Honesty and economy distinguish the administration of this model little government. It is a so-called free port, but its custom house receipts are upward of £140,000 annually, and £50,000 or £60,000 of that total is derived from the import duties on wheat, and £40,000 from the duties on wines and spirits. The laboring clases pay these duties, but they don't seem to know it!

Malta is one of the busiest and most important ports in the Mediterranean, and in one year I have known 6,675 vessels to arrive in the harbor.

The following countries are represented in Malta by Consuls or Consuls-General: United States, Austria, Belgium, Brazil, Denmark, France, Germany, Greece, Italy, Morocco, Netherlands, Persia, Portugal, Roumania, Russia, Spain, Sweden and Norway, Turkey, and Tunis.

The real property of the island is, as near as possible, thus owned: One-third by the Church and her priests, one-third by the wealthier inhabitants, and one-third by the British government, the latter succeeding to the property formerly owned by the Knights of Malta.

The franchise has lately been extended, so that now about 10,000 of the inhabitants are privileged to vote for members of council. The franchise is based on a money qualification, not on the intelligence of the voter. For instance, my Maltese cook, who pays not less than £6 per year for his house, but who cannot read or write, is a voter, whereas my intelligent friend Mr. Giovanni Vella, who is a gentleman and scholar, cannot vote because he lives with his father and pays no rent.

Education is, however, on the increase, for in 1842 there were but 3,833 scholars in the schools, and 12,390 in 1881. This year the scholars number upward of 15,000. About £20,000 is expended annually by the educational department. In 1881 the percentage on the native population of those able to speak, read, and write their own language was 16·50, leaving 83·50 illiterate or only able to speak their own tongue.

The Maltese is a most peculiar language. It is of Oriental origin, Arabic in its chief characteristics, but sprinkled all through with Italian incorporations. It has no grammar. It is phonetic and idiomatic. I will give you a sample. It is from a Maltese love song:

> Tridu tafu shbeiba sh taghmel,
> Min fil ghodu sa fil ghashia,
> Taghmel il boklif' rasa,
> U tokghodlok fil gallaria.

The translation of which is:

> Would you know what a maiden does
> From morning until evening?
> She adorns her head with curls,
> And seats herself in the balcony.

JOHN WORTHINGTON, U. S. Consul.

U. S. Consulate, Valetta, Malta, July 10, 1886.

THERE are in Germany 620 paper mills, 437 wood pulp mills, 42 straw pulp mills, and 39 mills making chemical fiber.

PHOTOGRAPHIC NOTES.

Reducing Over-intense Negatives.—Farmer's well-known method of using a fresh 5 per cent solution of hyposulphite of soda in which is dissolved a few grains of red prussiate of potash (ferridcyanide of potassium), for reducing intense negatives, needs no further description here, since it is now generally used by both amateur and professional photographers.

Quite recently, Mr. Edward Leaming, a member of the New York Amateur Society, experimented with this process, using a 5 per cent solution of hypo and a 10 per cent solution of ferridcyanide of potassium; and noticed that while the reduction took place very uniformly, yet, when the operation was finished, a yellow tinge was left on the negative, which in a measure counteracted the effect of the reduction, as it slowed the printing on silvered albumenized paper.

His remedy was to change the color of the negative, which was accomplished by putting it into a saturated solution of common alum. In a short time it was changed from yellow to a bluish color, making it well adapted for quick printing.

The reason of the change is due to the fact that commercial potassium alum contains iron as an impurity, and when it comes in contact with a mixture of a ferrous salt and the ferridcyanide of potassium, a bluish precipitate of ferrous-ferridcyanide results. This precipitate is known under the name of Turnbull's blue.

Sulphurous Acid for Developers.—In experimenting with this acid, we have found that the samples to be purchased from leading manufacturing chemists are not as powerful as they should be, and we lately were led to prepare a fresh solution by the simple method described in SUPPLEMENT, No. 460. We were much surprised to note the better keeping qualities of this freshly prepared solution. The pyro solution in which it was employed retained its full strength and kept perfectly clear, being very nearly colorless. As the sulphurous acid may be very easily and quickly prepared, we believe using it fresh is of much utility in preserving the pyro solution intact.

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court.—Northern District of Illinois.

DRUMMOND *et al. vs.* VENABLE *et al.*

PLUG TOBACCO.

Blodgett, J.:

A claim reading "As a new article of manufacture a plug of tobacco one or both faces of which are marked off by indented lines, which serve to secure the wrapper to the filling, and also as guides for cutting up the plug into small pieces of definite size and weight," is void for want of novelty, in view of the fact that it was common prior to the date of the alleged invention to mark cakes, candies, chocolate, etc., with indented lines to indicate measured quantities.

A feature of utility which is merely incidental to the main purpose of the invention is not of itself sufficient to sustain a claim where it is shown that the main purpose has been accomplished prior to the date of the alleged invention.

Patent No. 200,133, of February 12, 1878, to James Drummond, for an improvement in marking plug tobacco, is void for want of novelty.

U S. Circuit Court.—District of New Hampshire.

JENCKS *vs.* THE LANGDON MILLS *et al.*

Colt, J.:

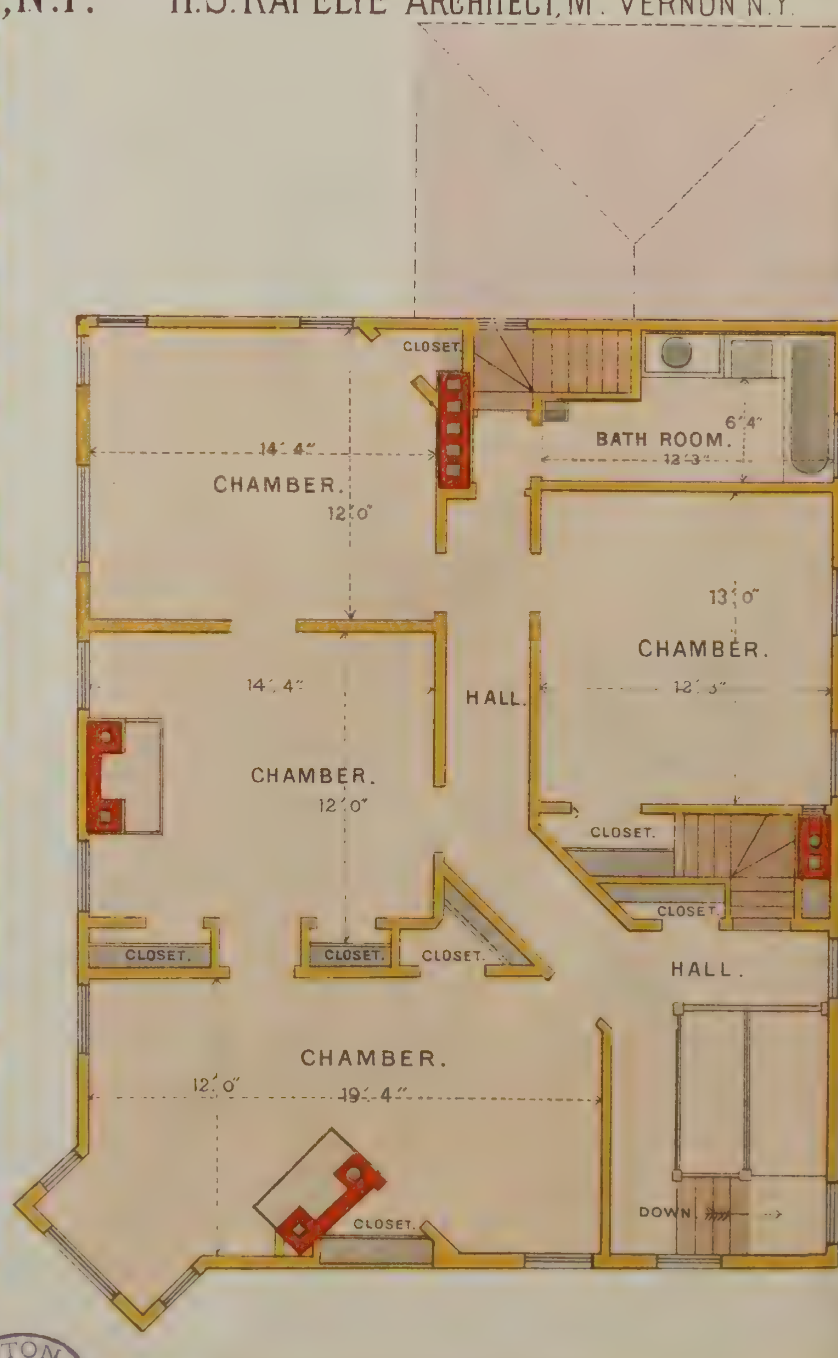
This bill in equity is brought for infringement of Letters Patent No. 168,644, granted the complainant for improvement in spindle bolsters. The suit is between citizens of New Hampshire, and the first question to be determined is whether there is a subsisting license between the plaintiff and the defendant corporation covering the patented bolster in controversy.

The plaintiff was in the employ of the defendant corporation as overseer or superintendent from June, 1861, to 1877. During this time he made several improvements in the machinery used in the mills. His patented adjustable rings were put into the mills in 1866 and 1870, and his patented traveler cleaner in 1868 and 1870. The patented bolster, upon which suit is now brought, was put in between 1875 and 1877. The date of the patent is October 11, 1875. The defendants contend that Jencks agreed to give the company the free use of his inventions as an advantage to him in introducing them elsewhere; that he was to make no charge for royalty, and that no royalty was ever paid; that he took the time which belonged to the company to devise and experiment with his improvements, used the tools, workmen, and materials of the company in making the improvements, and tested them in the machinery which was run by the company.

Held, When complainant was an employe of defendant company, and used the time it paid for, and its tools, workmen, and materials in experiment and perfection of the invention, and put it, when completed, in use in defendants' mill, and made no contract as to compensation or royalty, the law will infer a license to the defendant to use the invention in the particular mill without royalty during the term of complainant's patent.

A COUNTRY RESIDENCE AT YONKERS, N.Y. H.S. RAPELYE ARCHITECT, M^T VERNON N.Y.

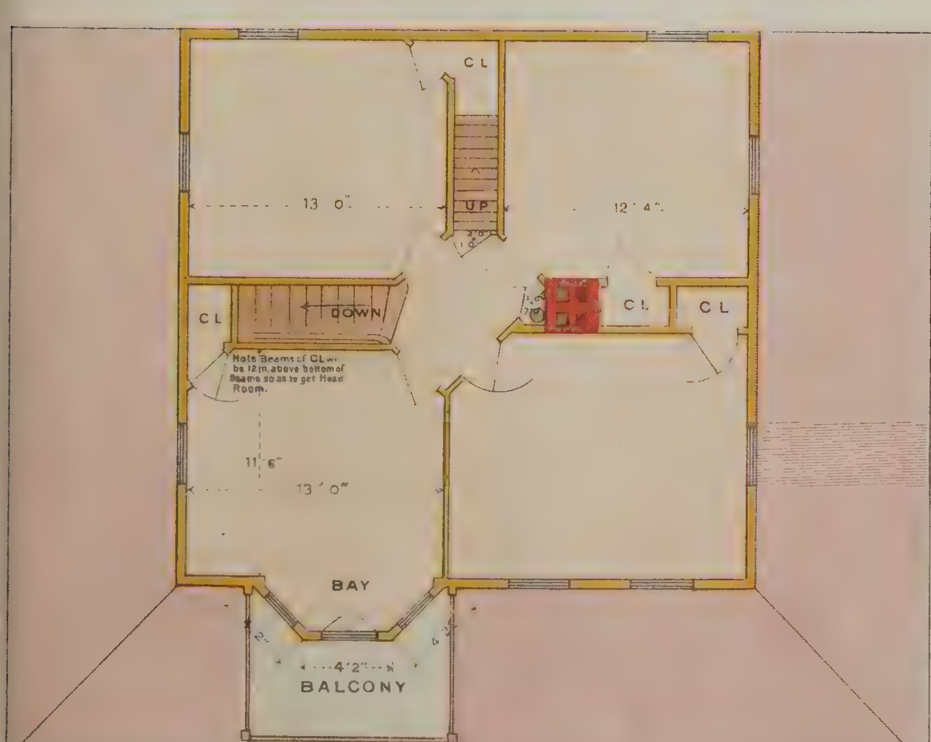
PRINCIPAL FLOOR PLAN.



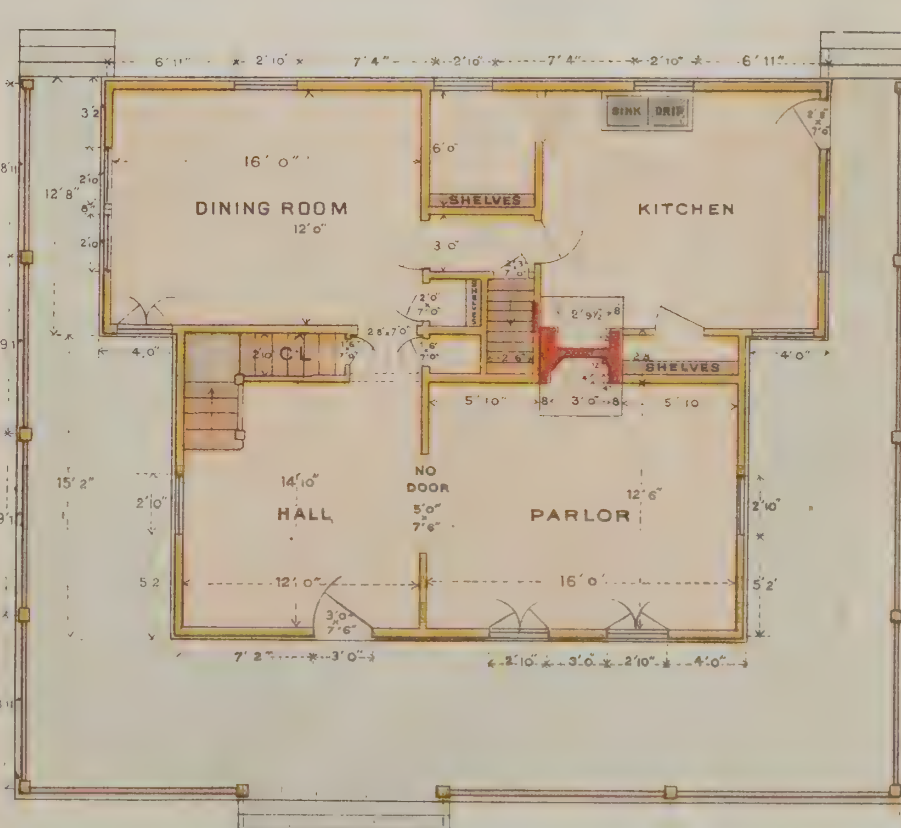
SECOND STORY PLAN.

SCHUMACHER & ETTINGER N.Y.

A Cottage at Block Island, R.I. Chas. E. Miller, Architect, New York.



Second Floor Plan.



Ground Floor Plan.

Concrete Floors.

These are sometimes formed on a centering of pieces of fir of proper scantlings resting on a trestle or on the lower flanges of the girders. Across these, transverse pieces are laid, and boarded with boards of, say, 1 inch thick and close jointed. The concrete is laid in bays; each is finished in one operation, so as to form a slab. The ingredients may be as follows: 1 part cement to 4 parts of breeze or other porous substance, iron slag, hard bricks, well burnt clay, which have to pass through a ¾ in. mesh. If fine stuff is required, clean smith's ashes may be used, as being better than sand, the fine stuff not exceeding one-third of the whole. Portland cement, if fine ground, capable of passing through a sieve of 2,500 meshes per square inch, should be used, and the following test is given: When made up wet and filled into a glass bottle, and struck level with the top, it must not in setting crack the bottle or rise out of it, or become loose by shrinking. When filled into moulds, and after being seven days in water, it must have an ultimate strength under tensile stress, slowly applied, of 250 pounds per square inch of section. The mixing is to be performed by turning the ingredients over twice dry, then shoveled to a third heap, at the same time adding from the rose of a hose water enough to make the ingredients cling together. The broken material and breeze should be damped before mixing. The concrete, after being laid, is slightly rammed with wooden beaters, and the surface should be kept damp by water fourteen days after laying. The soffits should be well wetted, and a setting coat of fine stuff given. These are the instructions given in a specification for concrete floors, and may be usefully followed. Slabs of concrete 6 inches thick have been found to break at from 1 cwt. to 2½ cwt. per foot super., the size of the slab being about 14 feet by 13 feet in the former case and 14 feet by 7 feet in the last. Experiments have not been sufficiently numerous or conducted with enough exactness to insure any reliable rule, the slabs crack suddenly, and there is little warning after the ultimate resistance has been reached.—*Building News.*

ILLUSTRATIONS OF MORNINGSIDE PARK, NEW YORK CITY.

A Great Steel Forging.

The steel forging for the fighting tower of the Italian armorclad Lepanto is 10 feet in outside diameter, 7 feet 11 inches inside diameter, 12½ inches thick, and 4 feet 9 inches high, and is intended to protect the captain of the ship in battle.

The weight of this huge block of steel is 30 tons, and the rough ingot from which it was forged was 65 tons. It was produced by the firm of Schneider & Cie., of Le Creusot, France. The ingot was worked to a diameter of about 6½ feet, then bored, and then worked by forging on a mandrel to the dimensions given above. It is the first fighting tower that has ever been made in one single piece.

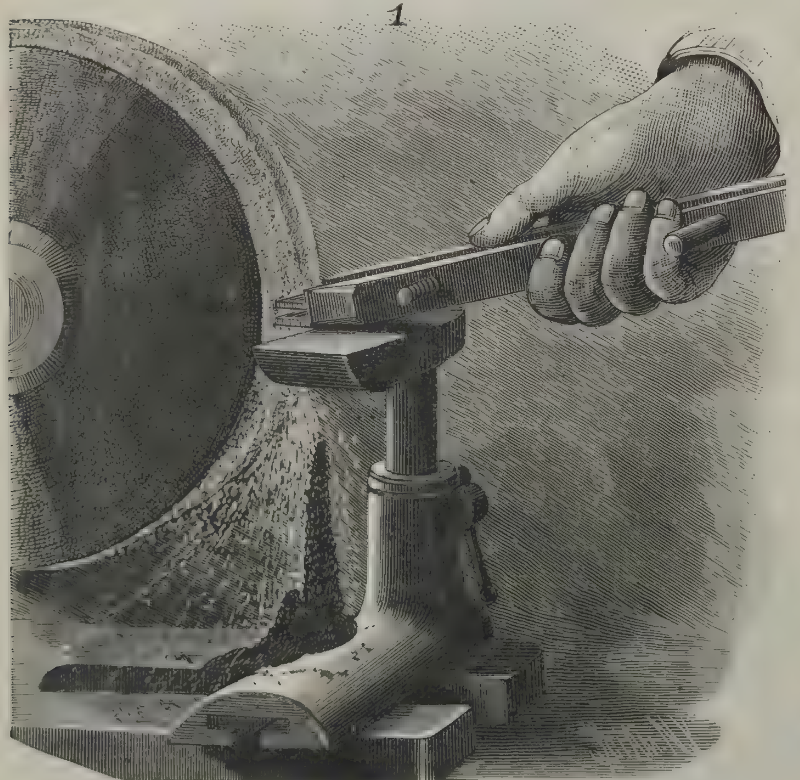
CURIOUS ACCRETION OF EMERY WHEEL DUST.

The particles of material removed from solid bodies by the abrasive action of dry emery wheels are always more or less heated. Dust from metals is often fused, and sometimes dissipated altogether. Fused globules of metal are frequently found in emery wheel dust, but the stalagmitic formation consisting of particles welded together, as shown in our engraving, is not common.

These curious growths are formed almost hourly by a wheel 14 inches in diameter, revolving at the rate of 900 revolutions per minute, employed in shaping some of the steel parts of a sewing machine. The position of the stalagmite relative to the work and the wheel is shown in Fig. 1. Under the microscope the particles do not appear to have been entirely fused, but only sufficiently softened to cause them to stick together.

The mass of the aggregation is quite solid and strong. Except in color, it more nearly resembles a spire of coral than anything else.

1



CURIOUS STALAGMITIC FORMATION OF EMERY WHEEL DUST.

2

STALAGMITIC ACCRETION OF EMERY WHEEL DUST.

NEW ELECTRIC ORGAN MOVEMENT.

The introduction of the pneumatic movement for organs was one of the great steps in the development of this instrument. By it the strain of directly opening the pipe valves was removed from the fingers of the performer, and a light acting manual, as easily played upon as a piano keyboard, was placed at his command. In the illustrations accompanying this article we show another improvement, that is as distinct a step in advance as the one just mentioned. By it electricity is called into play, and the pneumatic movement is controlled by the electric current.

In Fig. 1 a section of the mechanism is shown. The details of the pneumatic movement will be at once recognized by those familiar with it. It is controlled by the electric attachment, that forms the subject of this article. Within a wind chest a hollow cored electro-magnet, indicated by B, is mounted in a vertical position. A cylindrical armature, A, plays up and down below it. The armature and core are made of soft iron. The armature fits loosely in a cylindrical chamber directly below the magnet. Its top and bottom are covered with disks of leather.

Below the armature a nozzle communicates with the open air. Thus, when the armature rises, the opening in the magnet core is closed. When it falls, it closes the opening of the nozzle, C. The wind chest is in constant communication with the organ bellows, so that the air within it is maintained at a pressure above that of the atmosphere. Within it is a bellows that is held open normally by a spring. It will be seen that when the armature has fallen the bellows is filled with air from the wind chest. The pressure is carried down through the hollow core and space surrounding the armature and through the passage, W. The bellows, under the circumstances, remains distended and closes the valve, K, and keeps the valve, L, open. This leaves the outer bellows free to remain open or shut. The tracker attached to the arm at M, acted on by the pipe valve, pulls it shut, and no air is admitted to the pipe.

When it is desired to sound the pipe a current of electricity is passed through the wire. This draws up the armature, and closes the opening in the magnetic core, and at the same time opens the nozzle, C. The bellows in the wind chest, having its interior put in communication with the outer air, at once closes under the effect of the air pressure within the box. This opens the valve, K, and closes the valve, L, so that the outer bellows is forced open by the pressure from the wind chest. The tracker is caused thereby to open the pipe valve, and the pipe begins to speak. In Figs. 2, 3, and 4 different modifications of the magnets and armatures are shown.

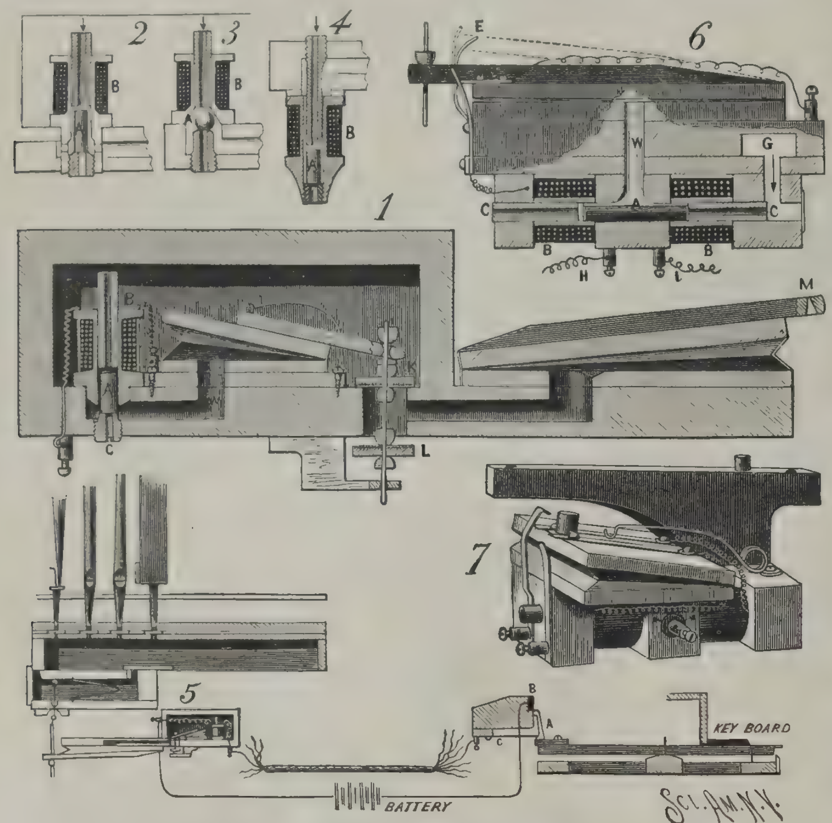
All this is done so quickly that a sensitive pipe can be made to speak six hundred times a minute.

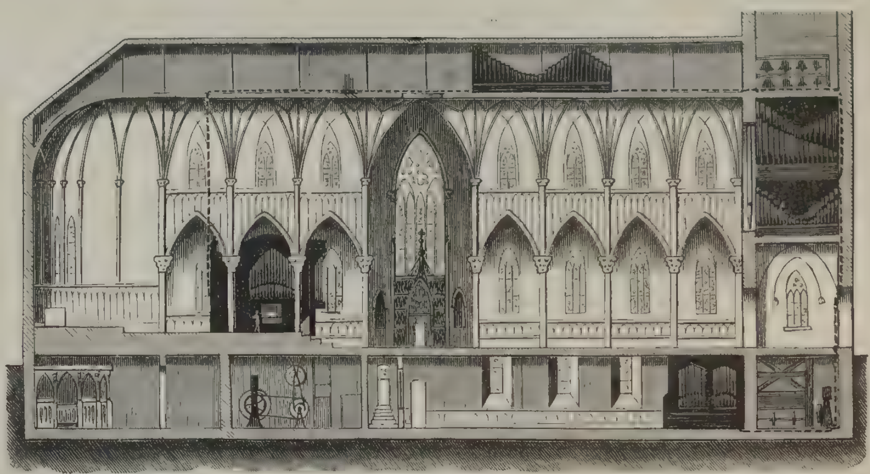
These are the pipe movements, and one such magnet and attachments are supplied for each key in the manual and for each pedal key. For the draw stops a somewhat different apparatus is provided.

It is clear that what has been described would answer for them, but with the attendant disadvantage that electricity would have to be supplied as long as the stop was kept open. In Figs. 6 and 7 a section and elevation of the draw stop mechanism are given, by which arrangement this difficulty is avoided completely. Referring to the section, two magnets, BB, wound in the same way are shown arranged horizontally, and supplied with a horizontal cylindrical armature, which is permanently magnetized. It is attracted to one or the other of the magnets, according to the one the current is caused to pass through. Air pressure from the organ bellows comes through the passage, G. When the armature, A, is attracted toward the left, as a current passes through the left hand magnet, this air pressure raises the bellows and opens the stop. As the bellows rises, the spring, F, breaks contact with the piece, D. This cuts off the left hand magnet from the line, but the polarization or magnetization of the armature causes it to retain its place. Hence the bellows stays open. But in rising by means of the spring, E, and another contact piece corresponding to it, it throws the right hand magnet into its own circuit. Then, when another pulse of electricity is sent by the opposite movement of the stop handle, it passes through the other magnet, and draws the armature to the right. The bellows under the influence of the spring shown in Fig. 7 collapses, closes the draw stop, and at the same time cuts off the current of electricity. A separate wire is provided for each magnet going from the draw stop handle, but a single return wire acts for both. The horizontal position of the magnets in conjunction with the polarized armature are the distinguishing features of this mechanism. The bellows acts by a tracker directly on the stop valve.

One of these movements is supplied for each stop, and thus the whole range is controlled by electricity. Very little current is required, as the draw stops are worked by a current of a second's duration. The manual consumes but little.

To give some idea of the connection between manual and soundboard, the section shown in Fig. 5 has been given. To the right is a key in its normal position. When depressed by the finger, it makes an electrical connection between the oscillating piece, A, and the contact piece, B. All the magnets connect at one terminal with a single wire, running from them to the contact piece, B, and including in its course the battery. Each of the other terminals of the magnets has its own wire which runs to the manual, each wire being connected by the binding screw and spring, C, to its own key. Hence, when a key is depressed it actuates the magnet connected with it, and makes the corresponding pipe give its note. On the left of the draw-





WACKER'S IMPROVEMENTS IN ELECTRIC ORGANS AS APPLIED IN THE CATHEDRAL, GARDEN CITY.

ing will be recognized in section the electric valve movement just described. A variation is here introduced by placing the outer bellows below, instead of above, the supporting board. The cable containing the individual wires, insulated from each other, is shown between the keyboard and movement, while above the movement is shown the soundboard, a pipe valve, and a row of pipes.

This arrangement leaves the manual perfectly free from strain. The keys, by being weighted, or by the use of springs, are made to work as easily or stiffly as desired.

What this invention effects is to render possible the playing of any number of organs from the one manual and by one organist, whatever be the distance of the soundboards from the performer. It is the invention of Mr. George Wacker, of 168th Street and Franklin Avenue, New York city, an organ builder of long experience, and, as this invention shows, a competent electrician. The complications and difficulties that beset the simple organ movement have to be allowed for, and here the skill of the organ builder is necessary. An electrician would not be able to cope with these difficulties any more than a mere organist could solve the electrical problems. A combination of the two was required in the solution of the problem.

The Stewart Memorial Cathedral, in Garden City, on Long Island, furnishes a good illustration of the practical application of this invention to the second largest organ in the world. There an organ with two hundred and forty keys in the manual, thirty pedal keys, one hundred and fifteen stops, and seven thousand pipes, is provided with this instrument. A sectional view of the cathedral accompanies this article.

The organ is divided into five parts. The main organ is in the chancel, immediately back of the manual. In the crypt under the front entrance is what is known as the "chapel organ." High up in the tower are the "tower" and "solo" organs, the latter unprovided as yet with its pipes. Then over the stone ceiling, between it and the roof beams, is the "echo organ." The bellows for the chancel organ are driven by a steam engine under it. A second engine and bellows supply the other four divisions. A small magneto-electric machine, run by a sewing machine belt, generates the electric current. At will the organist plays on one or the other of these organs, producing the most beautiful distance and echo effects.

In the processional hymn with which the service commences, the system is brought into play most effectively. The choir forms in the chapel, and is accompanied by the chapel organ. As they come up into the body of the church, the tower organ is brought into action. Then, as they approach or reach the chancel, the current being shifted from the tower, the chancel organ may take up the strain.

Each of the different divisions has its own manual for the convenience of the tuner. When the chapel organ is played from the chancel manual, the keys of its independent keyboard, the church's length from the organist, move up and down as the notes are sounded, producing a most peculiar effect, as if some invisible performer were seated in front of it, and moving the keys.

In the entire organ there are about four hundred of these magnets. Having no springs and no adjustments, when once in place, they are set forever. The great wind valves, sometimes of fourteen inches area, open and close with absolute certainty. The most beautiful effects of this great organ are due to and depend upon electricity, and it never yet has failed.

As an illustration of the size and range of the organ, it is of interest to note the largest and smallest pipes. The largest is 19 in. by 23 in. in area and 32 ft. long, giving 16½ vibrations per second (sub-contra C or C_3); the smallest, rather less than half an inch long, gives 16,896 per second, corresponding to the upper C (C^7)—a range of ten octaves, and practically covering the musical capacity of the human ear, though Preyer has claimed that from 16 to 41,000 vibrations per second, or an octave and a fraction higher, can be heard by some ears.

Tetanus Treated by Rest.

Dr. De Renzi states, in the *Rivista Clinica*, that by treating patients with traumatic tetanus by means of perfect rest, he has been able to restore four out of five to health; whereas, when treated in other ways, these patients usually die in two or three days. He places the case in a special room, where absolute silence reigns. Even in the passages leading to it and in the neighboring wards care is taken to lay down carpets, so that no sound shall penetrate the tetanus ward. The door of the latter is of course well oiled, so as to open and shut noiselessly, and the patient's ears are stuffed with cotton wool, he himself being strictly enjoined not to make the slightest noise. He must, of course, be fed. This has generally been considered impossible, the teeth being clinched and the spasmodic contraction being increased by attempts to masticate. The obstacle may, however, be easily overcome by parting the jaws and introducing liquid food through a curved sound; swallowing is accomplished without difficulty. This method of treating traumatic tetanus has been tried with success by several Italian practitioners—Drs. Pisani, Maragliano, Ria, etc. The only disadvantage is that the affection is sometimes prolonged for two months. It seems to increase in duration as it diminishes in force.

IMPROVED PIPE WRENCH.

This wrench is strong, durable, and very simple in construction, and not liable to get out of order. It is preferably made of cast steel, the serrated block being made of the best tool steel. For its gripping power it does not rely upon the spring, which is applied to hold the block in place when working the wrench in an inverted or overhead position. The gripping power is obtained by placing the serrated block eccentrically in relation to the hook-shaped jaw. To operate the wrench the block is simply closed on the pipe, and to remove it the handle is pushed backward, when the peculiar curve in the jaw will allow the wrench to easily leave the pipe. When using an adjustable wrench, fitting

THE FATKIN PIPE WRENCH.

pipes of various sizes, the pipe is liable to be crushed; but with a wrench such as this, three-fourths of the circumference of the pipe is covered, and that danger is obviated. It is claimed that the several sizes of this wrench can be furnished for the same amount that is now paid for one adjustable wrench.

Further particulars regarding this wrench, which has been patented, can be obtained from Mr. T. O. M. Davis, of Winifrede, W. Va.

Corundum and Its Uses.

Corundum in its pure state is composed of the oxide of aluminum, having the formula Al_2O_3, *i. e.*, it contains two atoms of oxygen in each molecule. It is an exceedingly tough, compact mineral, occurring in a great variety of colors—blue, red, yellow, to nearly white. The pure crystals are translucent, and used as gems. It is one of the hardest known minerals, being placed in the scale of hardness next to the diamond. This quality is the source of its greatest value in the arts. The species is divided into three varieties—sapphire, corundum, and emery.

Sapphire includes the purer kinds of fine colors, transparent or translucent. These stones are used as gems, and are known by names indicating their color. The following well known jewels are forms of this mineral: Ruby, sapphire, oriental emerald, oriental topaz, and oriental amethyst. These gems are found chiefly in the beds of rivers in Ceylon, though some rubies are brought from Syria. The value of these stones was well known to the ancients, who used them under various names now obsolete. The stone called sapphire by Pliny is now known to lapidarists as lapis lazuli.

The oriental emerald is perhaps the rarest gem known. A few specimens have been found among the gold sands of the Missouri River near Benton. But few of these jewels are in existence, and these are in the great collections of Europe.

Corundum generally means the dull, untransparent occurrences of the mineral. They vary in color—blue, gray, or brown—but are never clear or capable of being cut; it usually occurs in large, rough crystals, or in massive cleavages.

Emery is granular corundum. It is black or grayish-black in color, and mixed with grains of magnetite. Emery has very much the appearance of fine-grained iron ore, and for a long time was considered to be such. The texture is variable, some specimens being composed of almost impalpable grains, while others are made up of large, rough fragments of crystals.

Until recently the only source of emery was the far East, the island of Naxos, in the Grecian Archipelago, containing the chief mines. The emery was shipped from the port of Smyrna, and was known to commerce as Smyrna emery. Between the years 1835 and 1846 the entire business was in the hands of an English capitalist, who had a monopoly obtained from the Greek Government. In 1847 Dr. J. Lawrence Smith, an eminent American scientist employed by the Turkish Government to explore the dominion for valuable mineral deposits, discovered two large deposits of emery, one at Smyrna and the other on the site of ancient Ephesus in Asia Minor. These deposits have since then been worked by companies paying a royalty to Turkey.

Emery and corundum are chiefly used in the arts as abrading and polishing materials. The mineral is ground, and separated by passing through sieves into classes of various dimensions, which are then further prepared in different ways adapted to the purposes for which they are to be used. For the use of jewelers and opticians, the fine emery is poured into water containing gum, and the coarser particles allowed to settle; the fine, impalpable dust remaining suspended in the liquid is then collected and used in polishing fine lenses, spectacles, and similar articles. The largest amount of emery is used by the manufacturers of plate glass, though great quantities come upon the market prepared in a great many different shapes to suit special purposes. One of the largest of these industries is the manufacture of emery wheels; these are prepared by mixing the powder with glue or cement, and subjecting the paste to great pressure. Mixed with paper pulp and rolled into sheets, it is sold in the form of patent razor strops and knife sharpeners. Spread out on paper and cloth, it forms an excellent substitute for sand paper. Recently it has been discovered that crystallized corundum, when ground, forms a better abrading material than emery, owing to the fact that it breaks into sharp edged fragments, while emery has rather a rounded form. This discovery was followed by the discovery of large deposits of corundum and emery in Massachusetts, North Carolina, and Georgia. All of these localities are being actively worked, and large quantities of American material are being put on the market.

In the near future it is probable that corundum will assume a far more prominent place among the useful minerals as the source of the metal aluminum. The cheap production of this metal has long been the object of experiment to metallurgists; and corundum, furnishing the purest source from which it can be obtained, will probably be the most valuable ore. Even at present a good deposit of corundum is as valuable a "find" as one could desire to have on his property, there being a steady and regular demand for it. Corundum is generally found associated with crystalline rocks, such as granular limestone, gneiss, granite, or slate. The emery of Asia Minor is associated with granular limestone. The characteristic by which it is most readily distinguished by the prospector is its extreme hardness. A fragment of corundum will scratch any of the constituents of the rocks in which it is found.—*The Milling World.*

A Shying Horse.

To the inquiry, Why does a horse shy? the *National Live Stock Journal* replies: Because he sees something which he does not understand, and is filled with a greater or less degree of fear, something as the boy feels when he shies at the burying ground, and goes around to keep clear of it. It may be some new or unusual object that the horse sees, or it may be an imperfect view of it. Even a familiar object, if it comes to view suddenly and unexpectedly, will cause a horse to shy or jump, just as an unexpected object or sound causes a nervous person to start. When a person is so startled, how much would it improve the matter to be scolded at or given a cut with a whip? Just as much as the same treatment would in the case of the horse. Harshness only aggravates the matter.

The more the horse is scolded and whipped, the more nervous he gets; and every time he passes the place where the fright and whipping occurred, he will recollect the unpleasant affair, and he will begin to prick up his ears and fidget, ready for another jump. Give him the lines, and he will go by in a hurry. The proper way is never to strike or scold a horse that is startled or frightened. Speak to him coolly, calmly, and kindly; give him time to see and collect his scattered senses, and make him feel that you are his friend and protector. When he sees that all is right, there is an end to all further trouble. We have seen a horse refuse to cross an unsafe-looking bridge; but when the driver took him by the bits and walked ahead, the horse cautiously followed. Next time he required no coaxing or urging to cross the bridge. He might have been whipped into it at first, but was not the milder course, although a little trouble, the better one? The horse showed his confidence in the driver ever afterward.

EXTERIORS OF SMALL DWELLINGS.

The owner of a small farm wishes to erect a cheap dwelling; and while he has not the means to use costly ornaments, he wishes to secure "a neat and symmetrical exterior," and desires suggestions from us. In compliance with his request, we give a few small views of houses of moderate or small cost, from

Fig. 1.

which he may make a selection, and we trust they will afford useful hints to others of our readers.

For a quite small house, Fig. 1 gives a view of one with both neatness and symmetry, the only part of which requiring a single dollar in expenditure for the sake of ornament is the curved top of the front entrance. The broad eaves and brackets are an essential protection of the walls from storms and rain, and their cost is small. A dwelling may be built after this style, with small dimensions, with two rooms below, besides the kitchen added, and with two sleeping apartments above stairs; or it may be made larger with double cost, and wider rooms with ample closets.

A handsomely built Gothic cottage is represented by Fig 2. The steep roof of this style has the advantage

Fig. 2.

of less danger of leakage from rains, and is well fitted for a slate roof. The house is of larger size than the one last described, and rather more attention is given to ornament.

A cottage intended for nearly all the room which it gives to be on the common floor, to avoid frequent passing up and down stairs, is shown in Fig. 3. It makes no pretension to outside ornament, and yet such a dwelling neatly constructed, and surrounded with handsomely planted grounds, might constitute a rather pleasing as well as comfortable home.

For a neat farm house, with a slight air of elegance, Fig. 4 is a good representation of the bracketed style. But little explanation is needed. Cheap and substantial side walls are made with boards or plank outside, with vertical battens both outside and within; and on the inner battens thick, tarred building paper, with battens again on this paper to receive the lathing and plastering. We have found dwellings constructed in this way to be quite as secure from cold winds as the best walls laid in with brick, where they possessed some additional advantages.—*Country Gentleman.*

THE PEOPLE'S PALACE, LONDON.

The foundation of a People's Palace at the East End, London, was lately laid by the Prince of Wales. The funds for this undertaking originated in a nucleus of £12,500, part of a larger sum left for the benefit of the East End by Mr. Barber Beaumont. About an acre and a half will be covered with buildings, leaving three and a half for recreation purposes, such as running, cycling, tennis, etc. The Drapers' Company have contributed £20,000 for the establishment of technical schools and ranges of workshops, where all the principal trades carried on at the East End will be taught by practical artisans, so that no lad in future need begin life without the knowledge of some trade. These buildings are designed for the accommodation of 20,000 students. Indeed, the trustees wish to see the whole institution so framed that, whether in science, art, or literature, any student may be able to follow up his education to the highest point; in fact, that the Palace may become the university for East London. At the same time, the Palace will afford ample means for recreation and social enjoyment. There will be a winter garden and concert hall, a library and reading-rooms, gymnasia, and a swimming bath (the last contributed by Lord Rosebury), and, as we have said, an extensive recreation ground, where on summer evenings efficient bands are to be provided, so that workmen, with their wives and children, may find a pleasant resort for social intercourse after the day's work is done. The main building, of which we give an illustration, is to be constructed from the plans of Mr. Robson. The architectural features are decidedly Oriental. The structure is to be of red brick and white stone, and facing the main thoroughfare will be a semicircular portico, supported upon columns, and surmounted by a large and handsome dome, right and left of which will tower a lofty ornamental minaret, capped by a gilded cupola.

Under the dome will be the large entrance hall, intended during the day time to serve as a covered playground for the children, and in the evening as a species of common room, in which the workmen may sit and chat. Opening out from this will be "The Queen's Hall," where the concerts will be held, and of this the Prince laid the foundation stone on June 28. Beyond will be the library, reading-rooms, schools, etc. The Palace is to form a center for the formation of cricket, football, cycling, and other clubs, and the trustees hope to secure a suitable ground for the use of such clubs.—*The Graphic.*

Professional Statistics.

The number of men in the three professions—divinity, law, and medicine—was, in 1880, 254,520, of whom

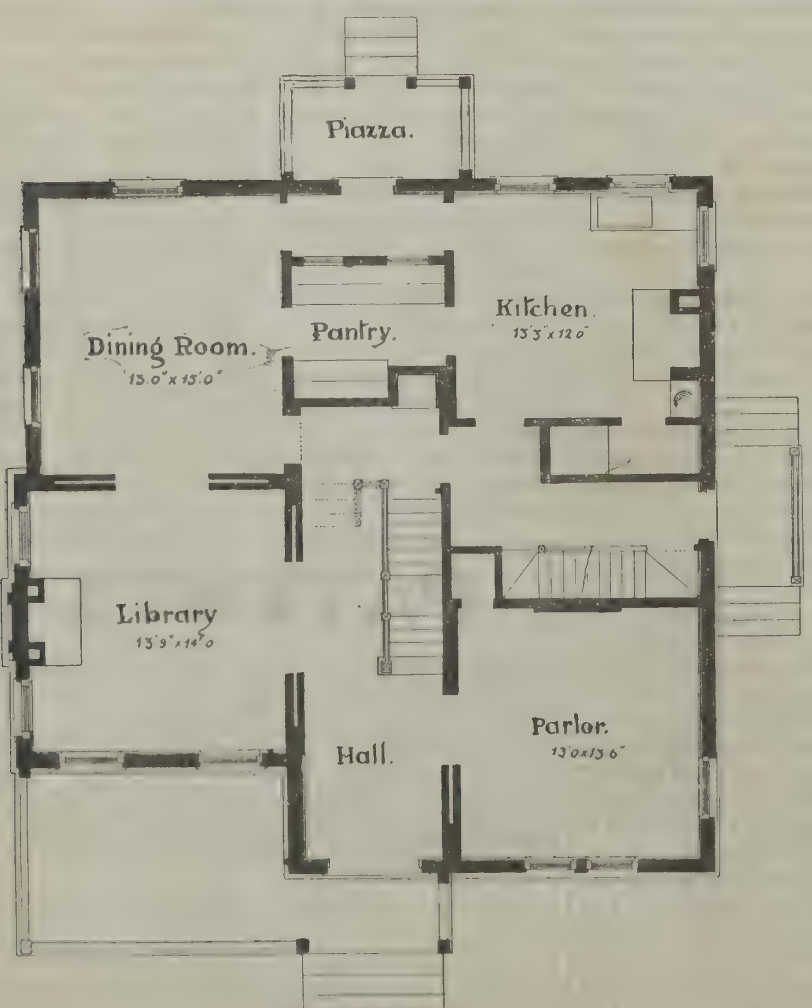
Fig. 3

64,698 were ministers, 64,137 lawyers, and 85,671 physicians and surgeons, 12,314 dentists, and 27,700 pharmacists. Hence the proportion in the learned professions (so-called) is about 1 to 200 of the population. The proportion of ministers and lawyers is very nearly equal, and is 1 to 782 of the population. The proportion of physicians and surgeons is 1 to 584, and of dentists 1 to 4,000.—*Journal of Education.*

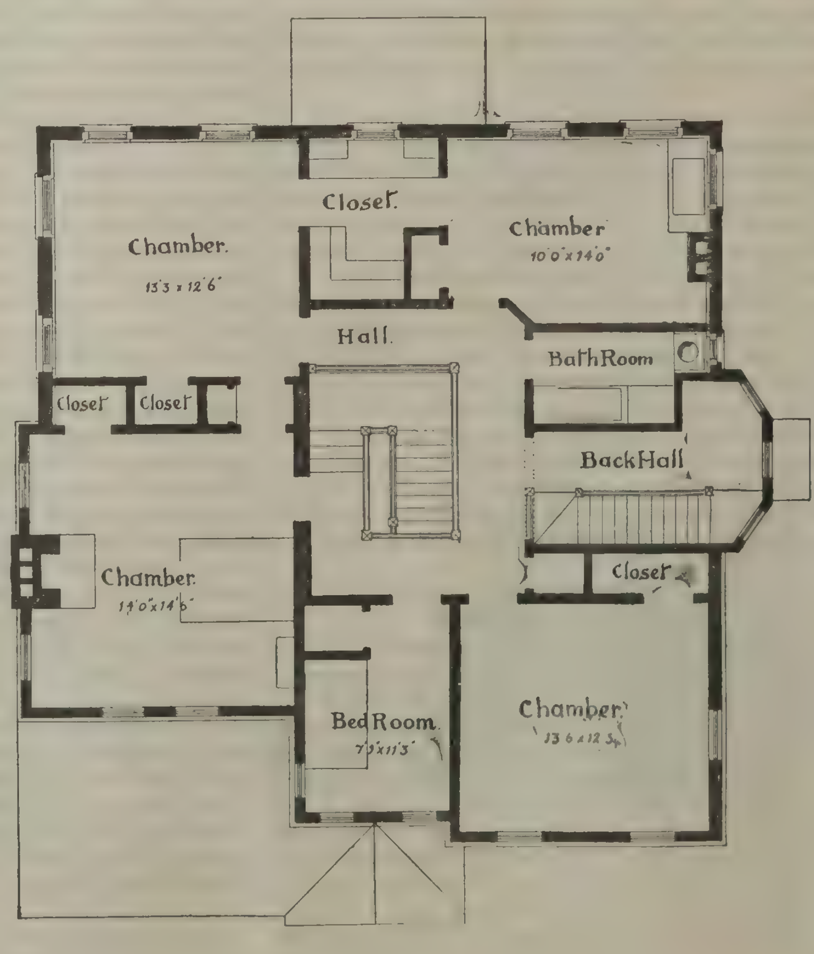
Fig. 4.

DESIGN FOR A RESIDENCE.

In our last number on page 28 we gave the perspective elevation of an excellent design for a country residence by C. H. Stilson, architect, New Haven, Conn., and promised to give the floor plans in our present number. We accordingly present them herewith. This house has a very pleasing exterior aspect, while the interior is conveniently arranged, and might, if required, comfortably accommodate two families



First Floor Plan



Second Floor Plan.

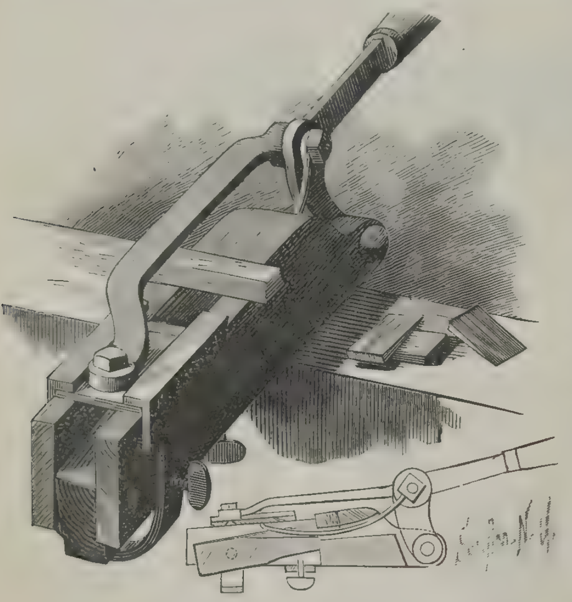
FLOOR PLANS FOR A RESIDENCE.

FOR PERSPECTIVE ELEVATION SEE AUGUST NUMBER, PAGE 28.

THE NEW PEOPLE'S PALACE, LONDON.

WEDGE CUTTER.

The engraving shows a simple contrivance for cutting wooden wedges rapidly and all of uniform size. A gauge block is placed between the prongs of a forked wooden or metal block, and adjusted in proper position for the wedges to be cut by means of screws, one of which passes through a cross piece on the bottom of the block, and the other through one shank of a stirrup extending under the forward end of the block. The thickness and taper of the wedge can thus be easily obtained by raising or lowering either end of the gauge. To the angle of the angle lever, which is pivoted to the rear end of the block, is pivoted one end of a curved bar whose forward end is secured to a cutting blade sliding in guides attached to the shanks of the block. Upon raising the handle, the piece of wood from which the wedge is to be cut may be placed upon the gauge and against a block held at the inner end of the prongs. The blade has its bottom slightly hollow ground at the cutting edge, and on its top it has a short steep bevel at the cutting end and a longer flat bevel behind. Upon pressing the handle down, the steep bevel splits a piece from the block of wood, which is then removed. The surface of the piece split from the block is then shaved off clean by the blade. The handle is then raised, whereby the blade is withdrawn and the wedge formed is thrown out at the back of the blade by a wire attached to the angle of the lever and passing through the main block and



JENKINS' LIGHTNING WEDGE CUTTER.

gauge, as shown in the sectional view. The connecting rod is curved so as not to interfere with placing the piece of wood upon the gauge.

This invention has been patented by Mr. James T. Jenkins, of Clements, Cal.

Influence of Magnetism upon the Embryo.

In the *Biologisches Centralblatt* we find a few interesting data relative to the influence of magnetism upon the embryo.

During the course of an artificial incubation Prof. Maggiorani submitted a certain number of hens' eggs to the influence of powerful magnets, taking care in doing so to keep at the same time an equal number of eggs away from all magnetic influence. The result was that, in the first group, four times more eggs were arrested in their development than in the second. After being hatched, three times more died out of the products of the first group than out of those of the second. Among the survivors, those of the second group all developed normally, while out of 114 of the first, 60 exhibited numerous imperfections or abnormal movements. Six chicks only of the same group reached maturity, and among these six two were cocks of remarkable size and appetite. Of the four hens, one never laid eggs, and the others laid very small ones, weighing about an ounce, and incapable of producing living beings.—*La Lumiere Electrique.*

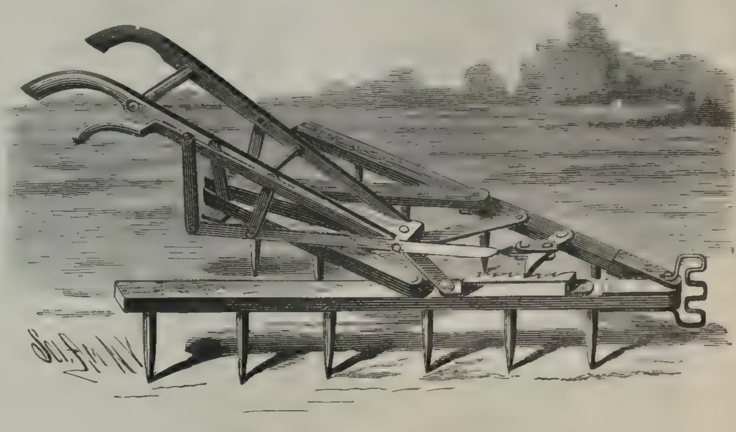
Mineral Wool.

In constructing fine houses builders now pretty generally use mineral wool between the floors and ceilings. This fibrous metallic substance is produced by sending a blast of air or steam through a jet of molten slag when it flows from the furnace. Having sustained the heat of fused iron, it is non-combustible and free from organic matter, so that it cannot rot or harbor any vermin. It is completety soundproof, and may be termed an absolute non-conductor of heat, for a layer of one inch thickness, says our informant, may fuse on one side while the other will remain cool. These properties, combined with its extreme lightness, have since its introduction a few years ago as a new building material made it a great favorite with architects and builders, and it is now largely used as a sound and fire proof filling between floor and partitions, and in attics to keep out heat and cold.

AN ADJUSTABLE HARROW.

A form of construction which permits the adjustment of harrows narrower or wider, as the work to be done may require, is shown in the accompanying illustration. The harrow has outer and inner toothed bars, with a center bar and its braces hinged to each other, so the harrow can be contracted and expanded. The hinged parts are supported against the resistance of the soil by a ratchet bar attached to one of the outer toothed bars and a pawl pivoted to the other outer toothed bar, the pawl being raised from the ratchet bar by a lever pivoted to the center bar of the harrow, to allow the harrow to be contracted by the resistance of the soil when the horse is started forward. The harrow can be expanded by raising its rear end by the handles, and then pushing the center bar forward with the foot until the desired width is obtained. In the case of large harrows the center bar affords a convenient place for a driver's seat, when the handles may be omitted if desired. This harrow can also be used as a cultivator, and can be quickly adjusted or changed without removing the hands from the handles.

This invention has been patented by Mr. W. Boatner, of Woodville, Miss.



BOATNER'S ADJUSTABLE HARROW.

MACHINE FOR CUTTING SCRUB, CANE, ETC.

The machine shown in the accompanying engraving is adapted for trimming hedges, and for cutting any kind of scrub, rushes, cane, etc., and it may also be used for cutting hard wood up to three inches in diameter and soft wood up to four inches. It is particularly applicable for mowing on rough ground, as it easily accommodates itself to the inequalities and is not liable to become clogged. The cutter is very simple in construction, and the knives, which form the weakest part, can be quickly replaced when damaged. The axle of the drive wheels, which are $4\frac{1}{2}$ feet in diameter, revolves in bearings attached to a frame from whose forward part the tongue extends. To one end of the axle is secured a large beveled gear wheel that meshes with a beveled pinion attached to the forward end of a shaft revolving in bearings attached to the side bar of the frame. Upon the other or rear end of this shaft is a beveled gear wheel, meshing with a pinion upon a shaft revolving in bearings formed in the outwardly bent arms of a bar which is mounted, and turns upon the rear part of the first shaft. One arm of the bar has holes in it to receive bolts by which it is secured to the frame and thus held in position on the shaft. The cutter is mounted upon one end of the second shaft. When scrub, sugar cane, etc., are to be cut, the cutter is adjusted in a horizontal position, as shown in the engraving, the perforated arm of the bracket being bolted to the rear cross bars of the frame. When the machine is used as a hedge trimmer, the bracket is

THE "FAUGH-A-BALLAGH" SCRUB CUTTER.

turned and bolted to the frame in such a position as to hold the cutter vertically. The machine is light draught, two horses being sufficient in light scrub.

This invention has been patented by Mr. William McLaughlin, P. O. Box 26, Auckland, New Zealand; the machines have been most successfully used in both New Zealand and Australia.

Casehardening Steel.

When the peculiar shape of a cast steel tool or other piece is such that the ordinary processes of hardening and drawing may distort and spring it out of shape, casehardening is employed instead. This, as practiced with prussiate of potash (ferrocyanide of potassium), hardens merely the surface or "skin" of the steel, and does not affect the interior. Cast iron and wrought iron articles are frequently so treated to give their surfaces a hardness impossible otherwise to obtain; but this treatment is restricted in its employment on steel, to articles and tools where grindings and resharpenings are not required. If a rotary cutter for a milling machine, or a planer or lathe cutter, was so treated it would require to be recasehardened every time it was ground, as the steel coating given by casehardening is only superficial. Yet for temporary purposes a casehardened tool will do effectual work; the writer once did a considerable job in screw threading with a large tap made of wrought iron and casehardened, no steel of the proper size being available.

A Fast Illustrated Paper Press.

How to print large editions of finely illustrated newspapers quickly has been troubling the publishers of all such papers the world over. It is rather surprising that a Russian paper, issued in St. Petersburg, is the first to try a new press specially designed to do such work.

The press has been built by Denier, of Paris, and the idea is to have the printing of the illustrations done either before or after the reading matter, but during the same run of the sheet through the press. Thus the reading matter is made up in forms with blank spaces where the pictures go, while in the picture forms the reading space is left blank. There is an arrangement whereby the illustrations are inked by rollers separate from those used in inking the reading matter, so that fine ink can be used for the cuts and ordinary ink for the text. The making-ready is done as in all book presses.

The sheets are cut as they are printed, collected five at a time, and deposited on a receiving table without any tape touching the impression, and the copies when delivered in this manner are said to be as clean as when they leave the press.—*The Paper Mill.*

OLD FALCON COCOA HOUSE, CHESTER.

This is a very complete restoration of one of the most interesting of the Chester timber houses. It is the property of the Duke of Westminster, and it is said that it was the first property acquired by the Grosvenor family in Chester. It was for many years an old coaching inn—one of the most important in the town—and many a carouse its blackened timbers have witnessed ; but now it is tenanted by the Chester Cocoa House Company, and dispenses tea and buns with a somewhat hypocritical air.

Those jaunty, irregular old gables and bulged out windows do not seem quite to suit the matter of fact business going on inside, but appear to be looking back regretfully to the "merry old days." The building had fallen into a very bad state of repair ; the long row of windows on the first floor were partly blocked up, and the front on the ground floor was blocked up and filled with sash windows. These obstructions have been removed, and an oak bay window inserted, which was really necessary to support the ends of the joists.

The many coats of paint were removed from the timbers, leaving them a rich brown color. Inside the structure required great care, as there were no internal walls, only partitions carried on beams, which in many cases were quite rotten. The basement shows that this was the site of a mediæval house, and several of the stone arches remain.

Mr. George Smith, A.R.I.B.A., added some rooms at the back, and he was to have been employed for the restoration. At his untimely death last year the work was placed in the hands of Messrs. Grayson & Ould, architects, of Chester and Liverpool ; and Mr. Wm. Parrott, of Chester, was the builder. The drawing is in this year's exhibition of the Royal Academy.—*Building News.*

Preservation of Yeast.

It frequently happens that a brewery which is in full and successful operation has, for some reason or other, to stop work for a week or so, and there is then considerable difficulty in preserving the necessary quantity of pitching yeast for the renewal of the brewings. If recourse is had to some stock yeast from some neighboring brewery, there is great risk that the flavor and character of the beers may vary, for it is now well known that certain types of yeast produce beers of different flavors. It is, therefore, a matter of the greatest importance that sufficient of the regular type of yeast should be preserved pending the resumption of the brewings. The preservation of so unstable a substance as yeast is attended with much difficulty, and on this account is seldom attempted, but some experiments in this direction by M. A. Kiesewalter have been recorded in a Continental contemporary, and as the subject is of so much importance we propose giving the results he has obtained. He describes three different processes of preserving yeast, viz., by the use of glycerine, by the use of alcohol, and by drying. In the following notes will be found brief descriptions of these three processes.

PRESERVING YEAST BY GLYCERINE.

The yeast is washed several times, and then dried by pressure. The pressed yeast is then mixed with ordinary commercial glycerine in equal proportions. The mixture is placed in large bottles or jars holding about a gallon each, which are filled up to the neck. The neck is then plugged with some cotton wool soaked in salicylic acid, and the bottle or jar is closed by a cork covered with tin foil, and then sealed. Yeast treated in this manner can be kept for a long time in an icehouse without undergoing any change whatever. When again required for use, it has only to be washed with water, and it is then ready for pitching with.

PRESERVING YEAST BY SPIRITS OF WINE.

In this case the yeast is also pressed, so as to get it as dry as possible. The spirits of wine should contain 25 per cent of alcohol, that is, of specific gravity 0·970, and should have had some good hops kept in it for a few days prior to use. One pound of spirits of wine of the above strength is required for two pounds of the well pressed yeast ; and the mixture is placed in bottles or jars, closed with salicylized cotton wool, and corked as in the preceding method. Bottles are, however, not absolutely necessary, for the mixture of yeast and spirits of wine may simply be placed in a zinc basin and covered with a cloth to prevent dust falling on it. Whether placed in bottles or an open basin, the mixture of yeast and spirits of wine should be kept in an ice house. When required for use, the alcohol should be poured off, and the yeast only requires to be washed with water.

PRESERVING YEAST BY DRYING.

After being washed with water, the yeast is pressed, and then placed in spirits of wine, as in the preceding process, and left for some hours ; the alcohol is then decanted off, and the yeast submitted again to pressure. After having been thus treated and pressed, the yeast is spread out on a clean cloth, placed in a sheltered position, and there exposed to a current of air till quite dry. This dried yeast is put into thoroughly clean and dry bottles, which are closed by corks. Yeast preserved in this manner can be used by simply adding some of the powder to the wort. According to Kiesewalter's experience, yeast preserved in this way, and by glycerine, sets up a fermentation immediately on being added to wort, but the action of yeast preserved by alcohol is much slower. After being used several times, he found no difference whatever between the resulting yeast and that which was used for preservation ; it possesses absolutely the same properties, and produces beer of exactly the same type.—*Brewers' Guardian.*

OLD FALCON INN, CHESTER, ENG.

A Mammoth Passenger Station.

The Waterloo railway station, at London, has been opened for traffic by the utilization of the several new lines and platforms which have for some time past been in course of construction on the north side, and this station is now said to be the largest passenger terminus in the metropolis, covering an area of upward of 20 acres, and extending southward from Waterloo road to Westminster Bridge road. Owing to the continued increase of railway traffic, the enlargement of the station has been in progress during the last four or five years. What is designated the new station, on the south side of the old main line station, was completed about two years since, and did much to relieve the pressure caused by the great suburban traffic on the company's several loop lines branching off from the main line ; but this increased accommodation was found inadequate to the traffic demands made upon the company, and hence the further enlargement on the north side in the direction of York road, which has just been completed. It contains four additional double lines of rails and five new platforms. The station as now enlarged contains a total of 16 platforms and 19 lines of rails, having an aggregate length of more than four miles. A special feature in the arrangements of the station is the signal box at the entrance, which is said to be the largest in England, containing no less than 180 levers. Including the purchase of houses, lands, and compensation, the estimated entire cost of the station is said to be £350,000.

A BILL has been introduced in the House of Representatives at Washington providing that from and after March 4, 1892, the metric system of weights and measures shall be exclusively employed by the several departments and branches of the Federal Government in the affairs of the United States. The bill also provides that the metric system shall be taught in all schools supported or aided by the Government.

The American Forestry Congress.

In response to a very cordial invitation from the Colorado State Forestry Association and the Denver Chamber of Commerce, it has been decided to hold the fifth annual meeting of the American Forestry Congress at Denver, in September, probably the 16th to the 18th. This meeting promises to be of particular interest, for with it the Congress for the first time gives special attention to the unique conditions and problems presented by the treeless plains of the West. Hitherto its work has been directed almost exclusively to the conservation of existing forests and their economic utilization, but at the coming meeting it will consider the even more difficult problem of creating forests in a region naturally unfavorable to their growth. Papers giving the results of actual experience, and speculative discussions considering the relations of forests to water supply, the methods, profits, possibilities, and needed legislation concerning tree culture, are requested from members and friends. The titles of such papers should be sent to the secretary, Mr. B. E. Fernow, Dept. of Agriculture, Washington, by July 1, and the manuscripts themselves before Sept. 1.

An Old Gas Line.

Some thirteen or fourteen years ago a strong flow of gas was struck at Lardinsville, Pa., by parties who had been "wild-catting" for oil. The well was cased and the gas used to run an engine, the initial pressure being about 85 pounds to the square inch. As the operation was perfectly satisfactory, the experiment was tried of carrying the gas to an oil refinery, some three miles distant. The main in this case was only 3 inches in diameter, but proved so successful that a little later a 5⅝ inch pipe line was carried across country to the mills of Spang & Chalfant, at Sharpsburg, a distance of seventeen miles. The comparatively low pressure of the gas, and small size of the main, prevented the line from supplying all the fuel required by the mills, and as a consequence a certain amount of coal was used to supply the deficiency.

Owing to this circumstance, other manufacturers were not aware of the radical economy effected at these mills, and were less disposed to repeat the experiment. This old pipe line was laid nearly thirteen years ago, and with very little knowledge of the fluid it was intended to transport, but it has lasted admirably, and is still in use. The company has never had an explosion, and but one or two unimportant accidents. A rather interesting experiment was undertaken when the main was first laid. A ball, five inches in diameter, was placed in the pipe and the gas turned on. With a pressure of 85 pounds, it is said, the ball was just seventeen minutes in traversing the seventeen miles length of pipe.

The Locomotive Whistling Nuisance.

A well posted railway man says that the obligatory tooting of a locomotive on the New York, New Haven, and Hartford Railroad in an ordinary day's run involves a waste of steam requiring the consumption of 280 pounds of coal to renew. He estimates the whistling expenses of that particular railway at $15,000 per year. There is a similar waste in the blowing of the whistles of stationary and steamboat engines. It is a matter worth the serious study of practical railroad men whether they cannot devise a cheaper noise with which to give notice of the approach of trains to stations and grade crossings.

A Boy with Cat's Eyes.

The case of a boy of six years with eyes like a cat's has recently attracted considerable attention in Chicago. He was taken for treatment to the Eye and Ear Infirmary, where his peculiar case excited much interest among the oculists. A greater portion of the iris is absent in both eyes. In a darkened room, it was found that they were similar in nearly all particulars to the eye of a cat. There was an immediate expansion, and the eyes blazed in the dark like balls of fire. The child is able to see with greater ease in a subdued light or in the darkness, as too much light blinds him. He distinguishes objects at a distance much more readily than when placed a few feet from his face. The physicians declare it to be a genuine case of photophobia.

CARVED CABINET.

We give beneath, from the *Building News*, an illustration of a walnut cabinet with ornamental carved designs. The art of carving in wood is not as much practiced in this country as it should be. As an occupation for young people—boys or maidens—it is full of attraction. With a little perseverance almost any person may learn to do handsome work; and when the accomplishment has been acquired, there is no end to the pretty forms with which the apartments and furniture of the home may be adorned—to say nothing of profit to be derived from the sale of carved work by those who wish to earn money.

Mortars and Concretes.

PROPORTIONS OF MATERIALS.

Mortar.

1 part of ordinary quicklime and 3 to 4 parts of sand; or,

1 part of lime to 2 of sand and 1 of blacksmith's ashes or coarsely ground coke; or,

8 parts of Portland cement, 3 parts of lime, and 31 of sand (for stone walls); or,

8 parts of Portland cement, 3 parts of lime, and 27 parts of sand (for brick walls).

8 parts of sand, gravel, and pebbles, 1 of burnt and powdered clay earth, 1 part of pulverized clinkers and cinders, and 1½ parts of unslaked lime.

Common Stucco for Outside Work.

3 parts of clean sharp sand to 1 part of hydraulic lime.

Troweled Stucco (for Surfaces Intended to be Painted).

2 parts of fine stuff, without hair, and 1 part of very fine clean sand.

Cellar Floors.

1 part of Portland cement to 6 to 10 of gravel for the under portion, and 1 of cement to 2 of clean, sharp sand for the face. Usual thickness, 2½ in.

Cement for Outside of Brick Walls in Imitation of Stone.

18 parts of clean, sharp sand, 1 part litharge, 1 part plaster of Paris moistened with boiled linseed oil. The bricks should receive 2 or 3 coats of oil before the cement is applied.

Substitutes for Sand.

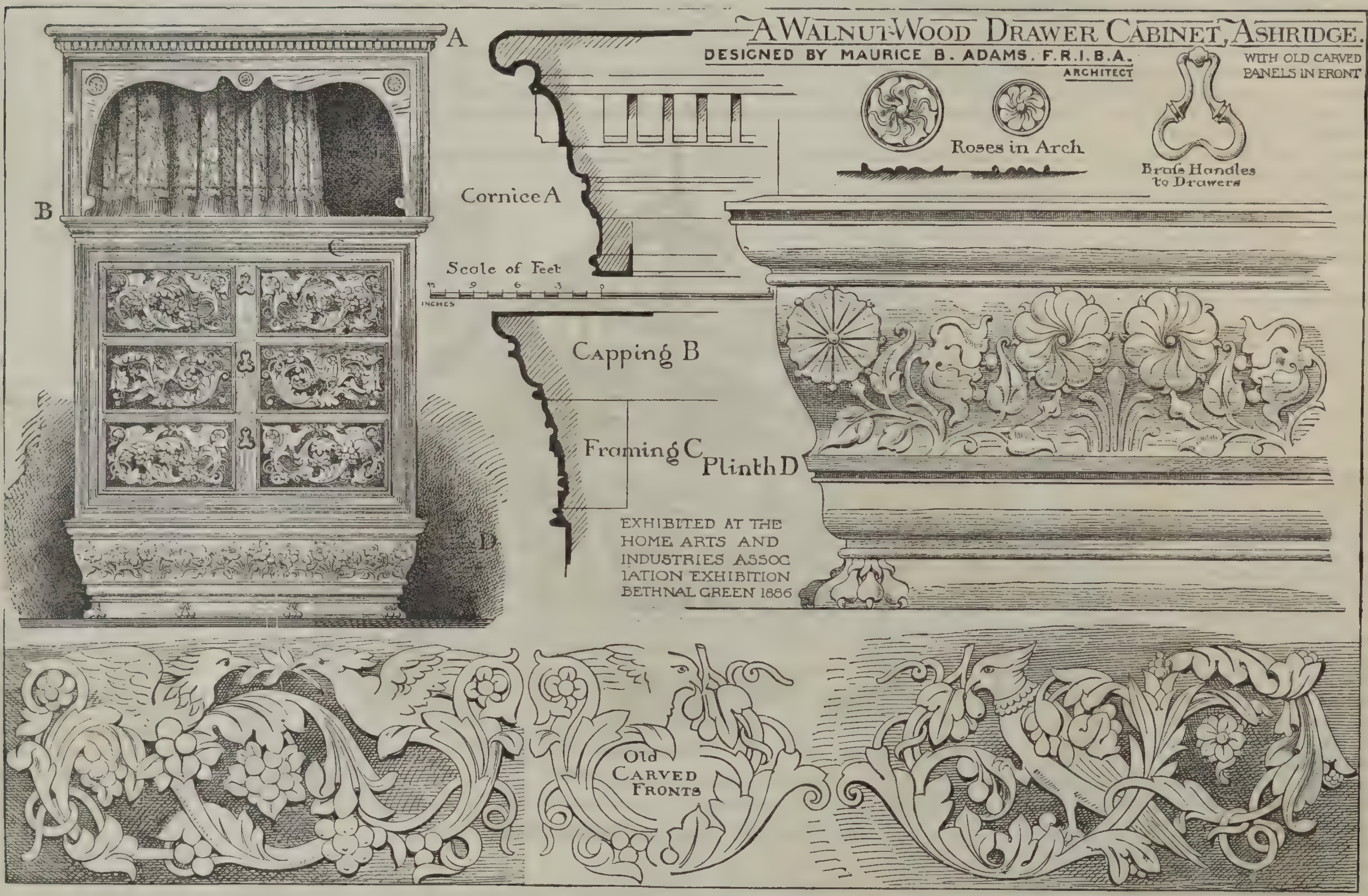
A stiff clay thoroughly burnt, and ground with the lime or cement; or,

The chips of sandstone left after a wall is erected and ground to a sufficient fineness; or,

Coarsely ground coke, clinkers from brick kilns, or furnace slag, broken and ground.

sand, the strength in equal quantities varying with the proportion of sand.

3. As a rule, lime of the white variety will bear the addition of a larger proportion of sand in admixture than the brown variety.
4. Bricks and stones should be thoroughly wetted before laying; and in concrete, where broken bricks or stones are used, they should be wetted in like manner before mixing.
5. The strength of concrete and mortar depends in a great measure upon the proportions of materials being kept true, a perfect admixture being effected, and upon a proper use of water in mixing, no more being added than is necessary to wet the mass.
6. The materials after being measured should be thoroughly mixed when dry and again manipulated after the water is added.
7. The sand or other material used as a substitute must always be quite clean and free from loam, salt, and earthy matter. The cleaner and sharper the sand, the stronger the concrete or mortar.
8. In using concrete for trenches, it is not advisable to throw the material from a height, as the different portions of the material, varying in weight, separate.



SUGGESTIONS IN DECORATIVE ART.—A CARVED DRAWER CABINET.

Cement Mortar.

1 part of sand to 1 of Portland cement. If greater tenacity is required, the cement should be used without sand; or,

2 parts of sand to 1 of Rosendale cement (for rubble stonework).

Mortar for Positions under Water.

1 part of blue lias lime to 2½ of burnt clay, ground together; or,

1 of blue lias lime to 6 of sharp sand, 1 of puzzolana and 1 of calcined mortar; or,

1 of blue lias lime to 2½ of burnt clay ground together.

Concrete.

1 part of hydraulic lime, such as blue lias, to 4 of ballast and 2 of sand; or,

1 part of Portland cement, 3 of gravel, and 3 of sand; or,

1 part of quicklime, 1 of Portland cement, 2 of sand, and 4 of gravel; or,

4 parts of powdered coke, 1 of Portland cement mixed with coloring material (for concrete blocks); or,

4 parts of Portland cement, 3 of lime, 16 sand, 32 broken stones or gravel, and 3 parts water; or,

60 parts coarse pebbles, 25 rough sand, and 15 of quicklime; or,

1½ parts of unslaked hydraulic lime, 1½ parts of sand, 1 of gravel, and 2 of broken limestone; or,

1 part of Portland cement, 2 of sand, 3 of gravel, and 4 of broken stones; or,

1 part of Rosendale cement, 2 of sand, and 4½ of broken stones; or,

Substitutes for Ballast.

Stiff clay or clay earth burnt by forming a bonfire of clay, coals, and wood; or,

Broken stones or bricks or pebbles, not larger than 2 inches on any edge; or,

Broken clinkers or iron refuse. In each case to be perfectly clean.

Proportions Before and After Mixing.

Lime and sand and, likewise, cement and sand lose about one-third of their bulk when made into mortar.

Limes or cements and sand require as much water as is equal to one-third of their bulk.

A cubic yard of concrete requires 34 cubic feet of material; or, if the gravel is to the lime as 6 to 1, a cubic yard of concrete will require 1·1 cubic yards of gravel and sand and 3 bushels of lime

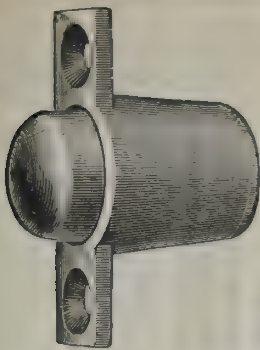
22½ cubic feet of mortar, or sufficient to lay 1,000 bricks of the average size, will require 22 cubic feet or 16 bushels of sand and 4 cubic feet or 3¼ bushels of lime.

Notes on Mortars and Concretes.

1. Mortars and plasters are all much improved by being worked or manipulated, and it is advisable that those composed of rich lime should be made in large quantities, and rendered fit for use as required by a second manipulation.
2. The addition of sand to lime in proper proportions considerably strengthens it, but Portland and other cements are stronger when mixed without

9. In forming foundations, it is the best plan to fill in the whole trench at one time; but where it is done in layers, each layer should be allowed to get quite hard before another is added, and should be picked up or roughened at the surface, and all dust and dirt swept away.
10. Concrete, when first laid, is full of minute holes. It should be well rammed, so as to force the materials closer together.
11. If concrete is to be placed in a position surrounded by damp earth (as in a foundation on clay), it should be protected from contact by a thin layer of sharp sand.
12. Blocks of concrete or artificial stone of Portland cement should be kept in water until ready for use.

PROTECTING IRON.—Some experiments have recently been undertaken by the administration of the Dutch State Railways upon the protective properties of various paints when laid on iron and steel. They have arrived at the conclusion that red lead paints resist atmospheric influences much better than those of brown red and iron oxides. The red lead adheres more closely to the metal, and also possesses greater elasticity. It was found to be a considerable improvement if the plates were pickled in hydrochloric acid before applying the paint, instead of being merely scraped and brushed. If the iron is to be exposed to the action of salt water, it is a good plan to mix magnesia with the paint made up with oil. This mixture forms an excellent ground coat on which to lay on the paint.



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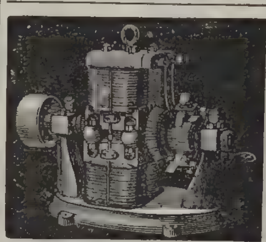

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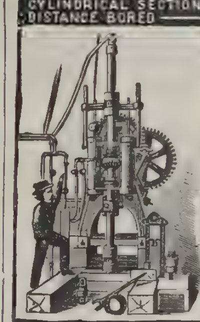

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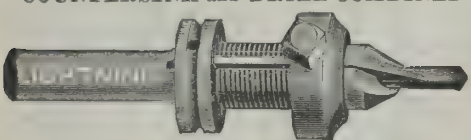

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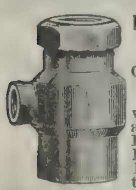

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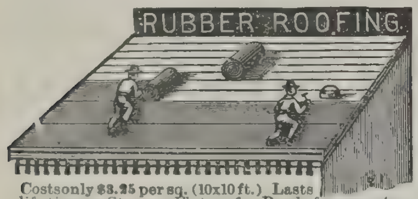

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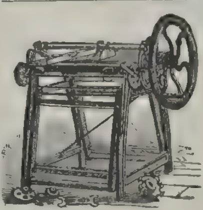

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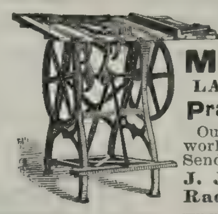

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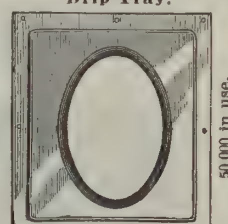

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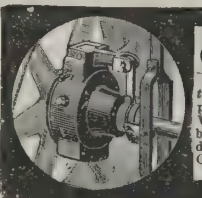

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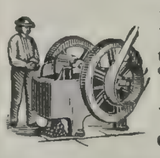

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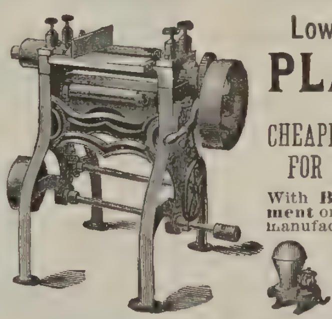

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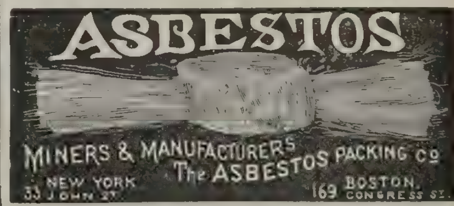

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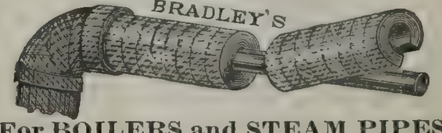

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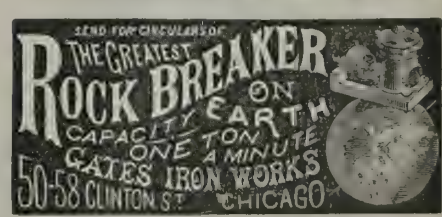

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HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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Minerals sent for examination should be distinctly marked or labeled.

(1) B. K. asks: 1. Can terra cotta be made from common clay? A. Yes, but it must be free from pebbles and other particles. 2. Can you tell me the name of a book that treats fully on the manufacture of terra cotta and pressed brick, also ordinary brick? A. Davis on Bricks, Tiles, and Terra Cotta, published by Henry Carey Baird & Co., Philadelphia. 3. In what State are the best pressed brick made? A. Pennsylvania. 4. Does not the smooth surface of pressed brick impair its adhesive quality somewhat? A. Yes. 5. Are the brick made the same size in all States? A. There is a slight difference in the sizes. Maine brick average 7·5 x 3·375 x 2·375 in.; North River brick, 8 x 3·5 x 2·25 in.; Philadelphia front, 8·25 x 4·125 x 2·375 in.; varying somewhat among different manufacturers and for different degrees of intensity in their burning. 6. What is the crushing resistance of pressed and ordinary brick? A. Crushing weight per square inch: Common brick, 800 to 4,000 pounds. Hard pressed brick, 2,000 to 4,300 pounds.

(2) B. J. B. writes: I am digging quite a large cistern (13 feet diameter and 10 feet depth); would be glad to know if it will be safe to put the cement directly over the clay sides, or whether a brick wall must be introduced. The cistern is circular. Is there any good recent work on the construction of cisterns? A. You may make a good cistern wall with a concrete of equal parts Portland cement, sharp, clean sand, and broken stone. But to make it thoroughly substantial the concrete should be rammed between a crib and the clay wall, so as to have a solid outside bearing suitable for the arch or cover. If you make a cover of concrete, make the arch nearly hemispherical, or half a sphere, for safety, although experienced persons could make it much flatter. For the arch use 50 per cent more Portland cement than noted above. Build the support with scantling and boards nearly to the form required, and cover with sand to give it a true form, and tamp the concrete around the outside first, filling in solid against the earth bearing for supporting the arch; finish at the hole in the center last. Make the arch at least 8 inches thick at center and 12 inches at the outside bearings. We know of no book on this subject.

(3) W. B. A. asks about making cement piping for conveying spring water. A. If you have but little pressure upon the cement pipe that you propose to make, you may make the pipe over a spindle of hard wood, slightly taper, just enough to allow it to be drawn out of the cement. Make a groove at the bottom of the ditch as nearly straight as possible, lay in the groove a course of cement of the thickness that you propose to make the tube; upon this lay the wooden spindle well oiled with linseed oil, then cover the spindle with cement. Proceed to make a second bed of cement, and draw the spindle forward nearly its length and cover with cement as before. The spindle may be from 3 to 5 ft. long; make the pipe from 1 to 2 in. thick, or for small pipe as thick as the diameter of the hole. Use pure Portland cement and water. Mix quickly and as thick as stiff mortar.

(4) C. M. B. writes: We have two dams across the Androscoggin River at this place, and when the water is at a certain pitch the sheet of falling water on the Topsham end of the lower dam presents a peculiar wavy appearance, and then a rattling of doors and windows occurs. Is it caused by the concussion of the air, or by the vibration of the ground? A. What you mention is a common phenomenon where there are wide sheet spill dams. The vibration of the water causes the air to vibrate, which is transmitted to considerable distance. The vibration of the air also extends to the ground, and sets buildings to vibrating. It can be stopped by breaking up the sheet of water into irregular divisions, or notching the dam so as to have thick and thin sheets in different sections. This breaks up the synchronism of the vibration.

(5) E. S. D. asks how many gallons per day (24 hours) will be required to supply the evaporation from an acre of land while it is covered with water 12 in. deep? A. The rate of evaporation depends upon the temperature of the water and the dryness, temperature, and velocity of the air. The published tables give as the average of fresh water evaporation in a calm 0·225 of an inch hourly, at a water temperature of 65° F.

(6) J. J. McV. asks: What are considered to be the best materials and proportion of ingredients, color, etc., for paint for outside iron work, like bridges of iron, railway and highway? A. There is nothing that stands wear and weather so well as red oxide of iron and boiled linseed oil. This may be tempered with chrome yellow, white lead, and lampblack for shades. On the great East River Bridge white lead is used. The elevated railways in New York are painted with Prince's metallic paint and chrome yellow. If it is not desirable to have the paint dry quickly, a little raw linseed oil mixed with the boiled makes an easier spreading paint and adds to its durability.

(7) J. S. H. asks how to make a paint or varnish to render wood waterproof, and that will resist ordinary lye. Something that can be applied cold and dries quickly preferred. A. We know of nothing that will quite do what is asked. Try paraffine, melted into the wood surface with a hot iron.

(8) J. G. R. asks if there is any formula for removing stains from a marble slab, caused by the acid from lemon juice. A. We should think that any stains caused by lemon juice would be easily removed by the application of cold water. The following, however, is strongly recommended as suitable for removing stains from marble: Take two parts common soda, one part of pumice stone, and one part of finely powdered chalk; sift it through a fine sieve, and mix it with water, then rub it well all over the marble, and the stains will be removed; then wash the marble all over with soap and water, and it will be clean as it was at first.

(9) F. K. McC. writes, asking directions how glass is stained permanently. A. Glass staining may be done at home by the following process: Spread over the glass a strong gum water, and when dry lay it over the paper on which the design is sketched, and trace with a fine hair pencil all the outlines. Dip the tube-like pencils in the colors, and let them flow out upon the glass; have a care, and not touch the pencil to the glass. The lights and shades are produced in a variety of ways; one of the easiest, and especially to beginners, is to take a goose quill cut in the shape of a pen, without the slit, and with it carefully take out the lights by lines and little dots. This part of glass staining is the most exacting and difficult, as much of the effect depends upon the shading. The glass is then ready for the kiln.

(10) D. S. M. Co. desire us to inform them of a preparation that will remove stains from black walnut, the stains being those made by liquor, etc. A. We know of nothing better to recommend than alcohol; oxalic acid and water are sometimes used to remove stains from mahogany furniture.

(11) C. R. asks: Is there any use for worn out porcelain bricks? Can they be reworked? A. We know of no use to which the bricks can be applied. They cannot be reworked.

(12) J. G. P.—A corrugated iron roof should be lined to prevent sweating, in places where the air is liable to become moist, or where many persons are congregated. Cover the frame with matched boards, then lay the corrugated iron.

(13) F. S. B. writes: Will you inform me what will harden tar for covering roofs? Have used resin and sulphur, but the sun makes it run. Is there anything besides asbestos that will harden it? A. You can boil the tar down as far as possible, and then cover the roof with gravel stones of a quarter to half an inch in size; or perhaps a more satisfactory method would be to mix the tar with hydraulic cement. We understand that this compound forms a very acceptable roofing material.

(14) F. J. S.—For carpenters' tonnage the rule is: Multiply together length, breadth, and depth, and divide the product by 95. You will find the various rules for tonnage in Haswell's Engineer's Pocket Book.

(15) J. D. G. asks a simple rule to determine the amount of condensation per square foot of surface on steam pipes of different thickness and temperature. A. We do not know of any simple rule such as asked for, but the following is the result of experiment. Steam pipes used for heating a room and maintaining a temperature of 60°, with good circulation, will condense 0·357 pound of steam per square foot of surface each hour; a coil under similar conditions will condense 0·29 pound of steam.

(16) J. A. D. asks: 1. Will concrete stand frost? Will it disintegrate by dampness or moisture? A. Concrete will stand frost if kept dry, but will disintegrate from the surface if frozen wet. It does not disintegrate by moisture alone. Much depends upon the quality of the cement itself. The best Portland is very hard, strong, and resists disintegrating influences longest. 2. Can water be charged with carbonic acid gas? If so, with what per cent? A. Water absorbs its own bulk of carbonic acid gas at ordinary temperature and pressure. At high pressures it absorbs many times its bulk.

(17) W. G. S. asks a recipe for a varnish, paint, or other coating that could be applied to iron scale beams, that are used in damp cellars in which large quantities of salt are used in curing hides. A. A coat of boiled linseed oil rubbed over the scales and allowed to dry is a good preservative. As the oil gets rubbed off by use of scales, rub the parts again with the oil upon a cloth. You cannot keep the scales bright and clean and prevent rust.

(18) C. P. F. asks: 1. If it will be wise to run his water pipe to a greater height than the roof, thereby securing water in case of fire on the roof. A. It would most certainly be wise to carry the water pipes above the roof. 2. How he can connect the pipe so as to insure an electrical contact between the joints? A. Screwing the pipes together strongly with plumbago and oil will give a sufficient metallic contact for all electrical purposes.

(19) J. H. M. asks for a fireproof paint. A. Take a quantity of the best quicklime, and slake with water in a covered vessel; when the slaking is complete, water or skim milk, or a mixture of both, should be added to the lime, and mixed up to the consistency of cream; then there must be added at the rate of 20 pounds alum, 15 pounds of potash, and 1 bushel salt to every 100 gallons of creamy liquid. If the paint is required to be white, 6 pounds plaster of Paris or the same quantity of fine white clay is to be added to the above proportions of the other ingredients. All these ingredients being mingled, the mixture must be strained through a fine sieve and afterward ground in a color mill. When roofs are to be covered, or when crumbling brick walls are to be coated, fine white sand is mixed with the paint, in the proportion of 1 pound sand to 10 gallons of paint; this addition being made with a view of giving the ingredients a binding or petrifying quality. This paint should always be applied in a hot state, and in very cold weather precautions are necessary to keep it from freezing. Three coats of this paint are deemed, in most cases, sufficient. Any color may be obtained by adding the usual pigments to the composition.

(20) J. B. O. asks for the composition of red and black cements to be used to unite concrete blocks in a sidewalk. A. For red cement use 1 part of Portland cement and 1 part of sharp, clean sand mixed with Indian red in sufficient quantity to produce the desired tint; and for black cement the same materials, omitting the red, mixed with about half a pound of lampblack to the bushel. In the latter case, ground coke may be substituted for the sand, if available.

(21) A. B. L. says: You give a receipt, on page 17, of a cheap concrete; among other parts is 1 part burnt and powdered common earth. Would coal ashes answer the same purpose? A. Coal ashes as a substitute for burnt and powdered earth in making the cheap concrete referred to will not answer, although it would do instead of the sand. The earth should be of a clayey nature, and, being well burnt, promotes the setting of the mass.

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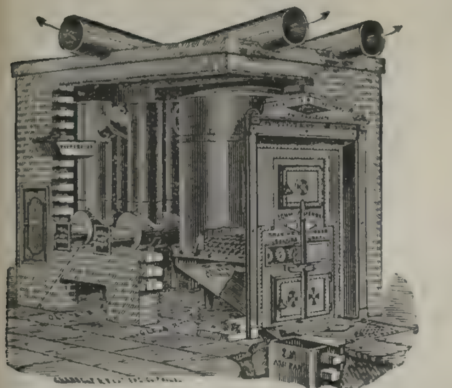
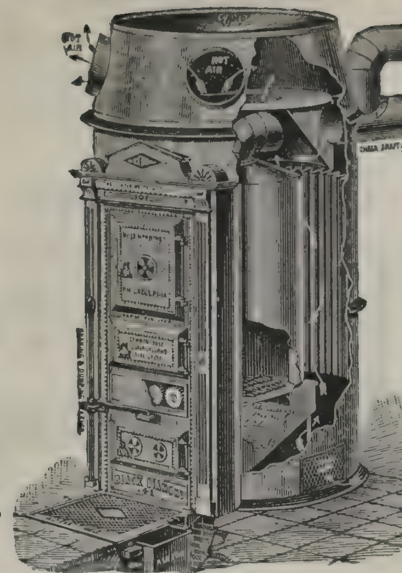


BRICK SET.



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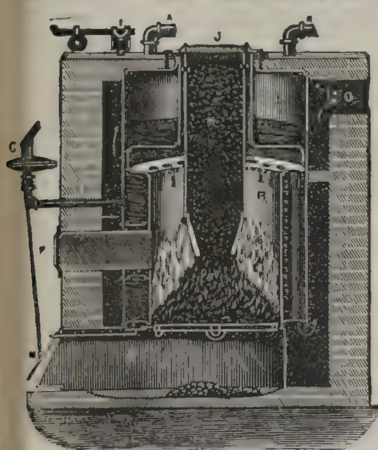

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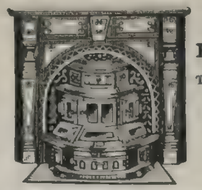

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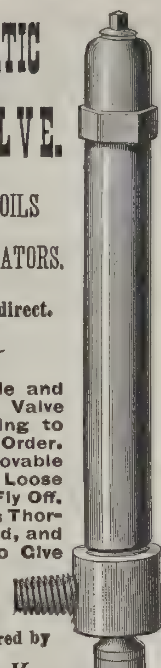

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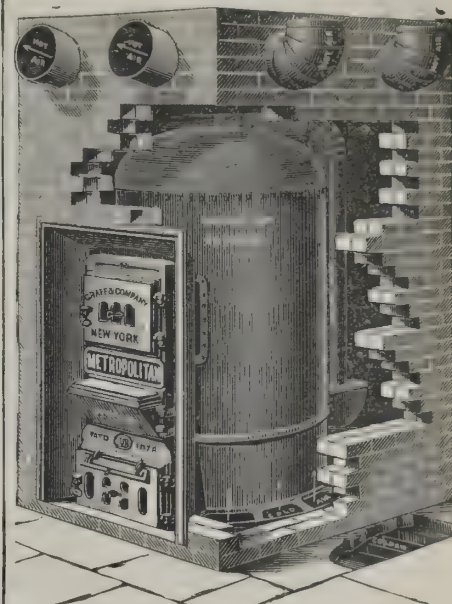

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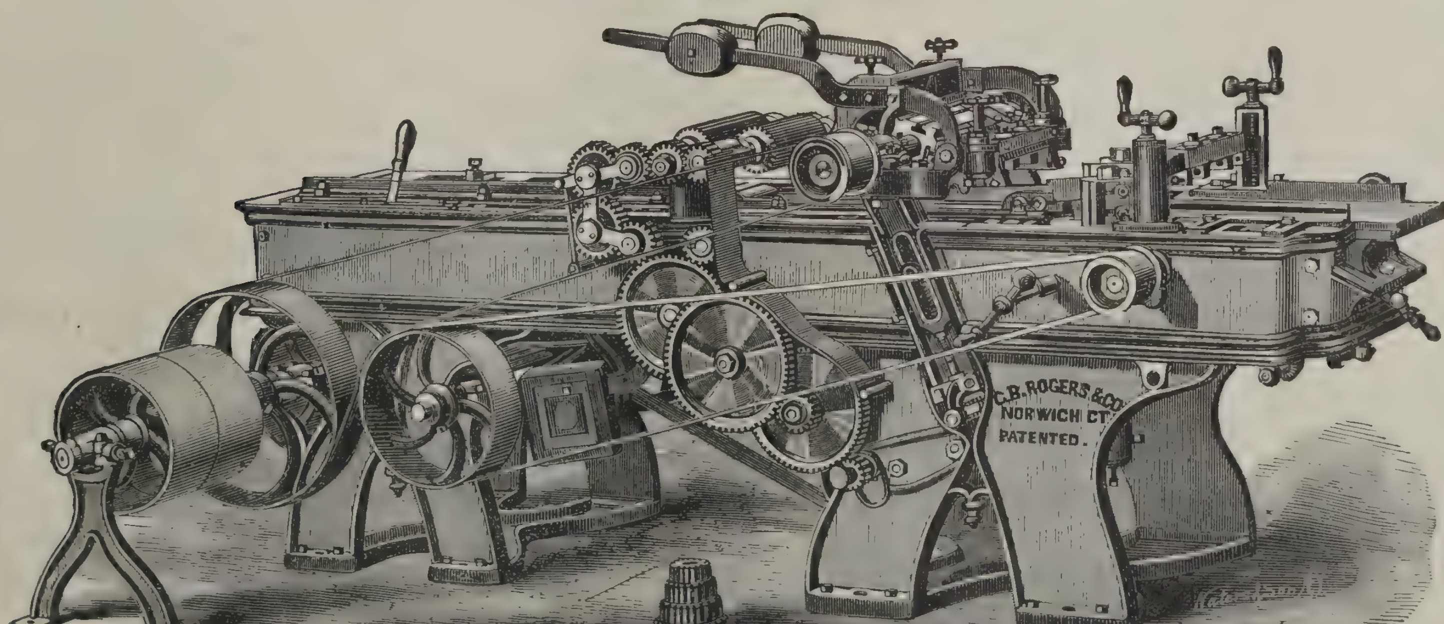

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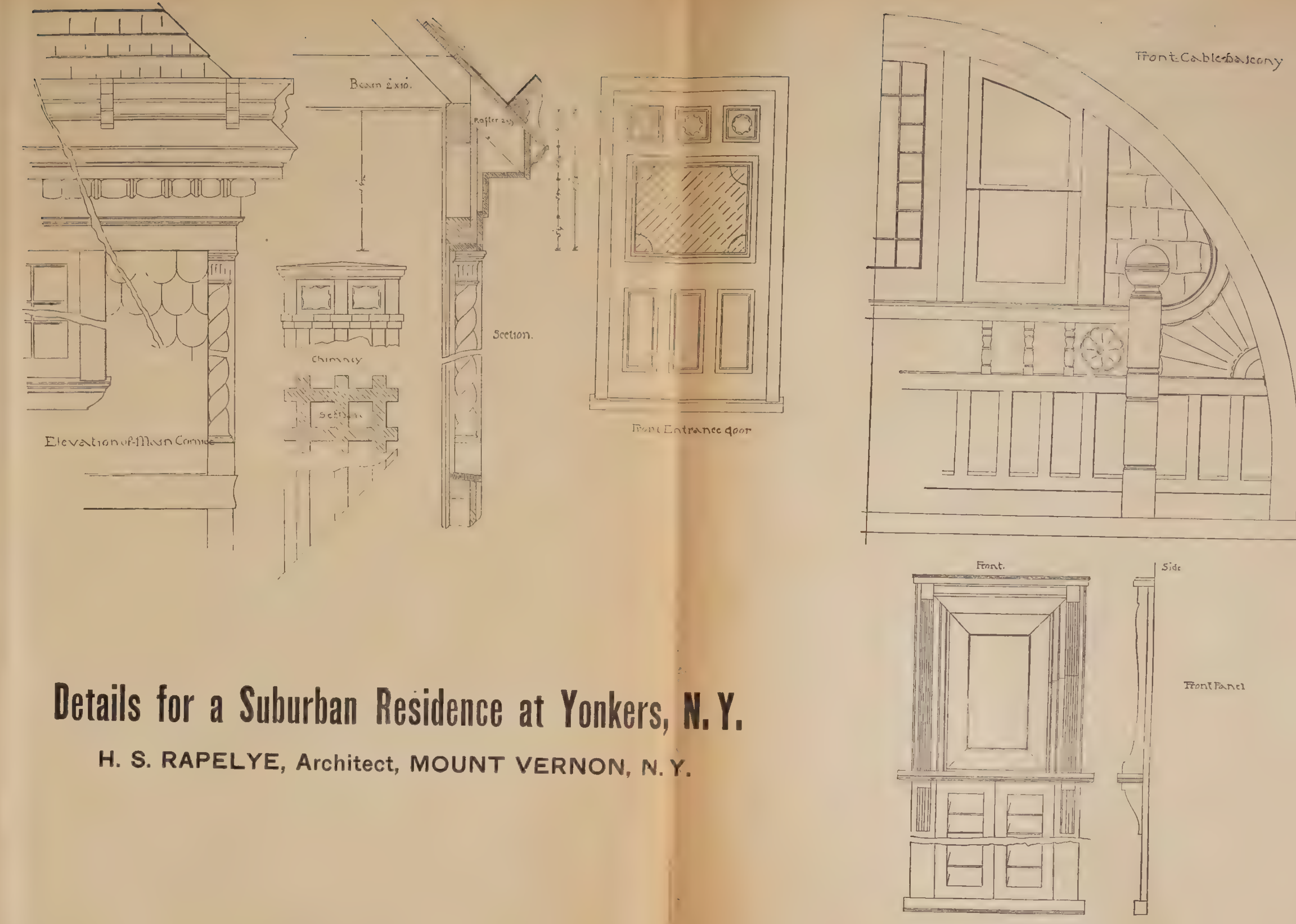
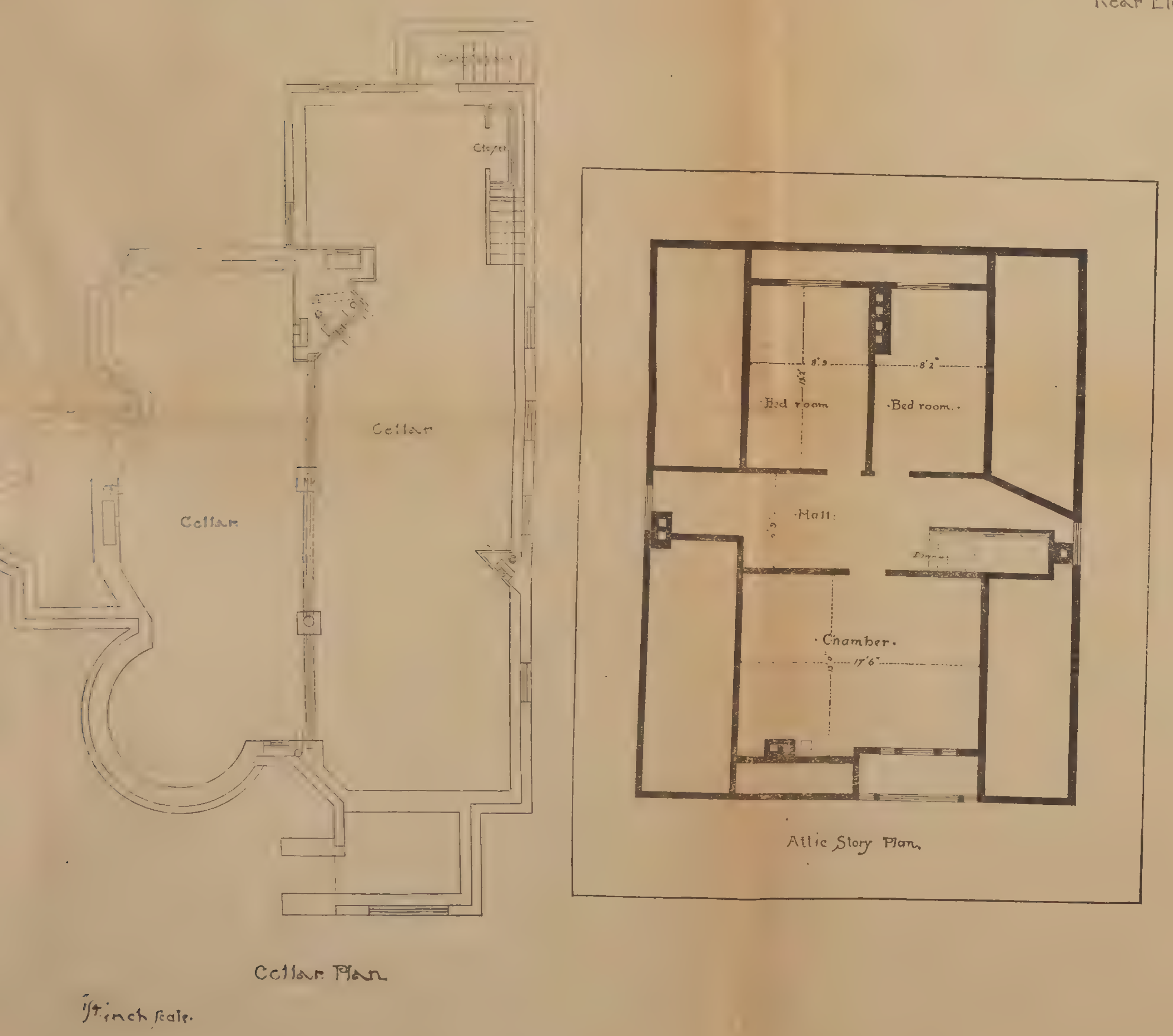
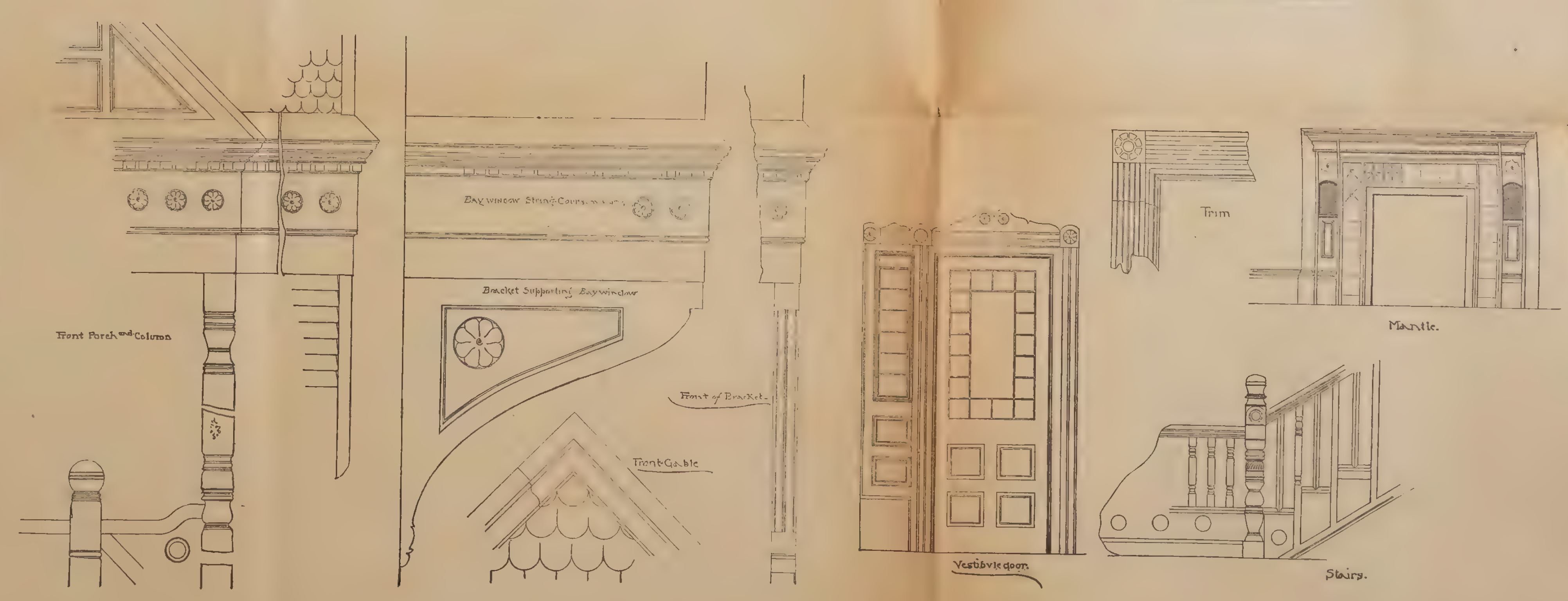


Details for a Suburban Residence at Yonkers, N. Y.

H. S. RAPELYE, Architect, MOUNT VERNON, N. Y.





Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for September, 1886.

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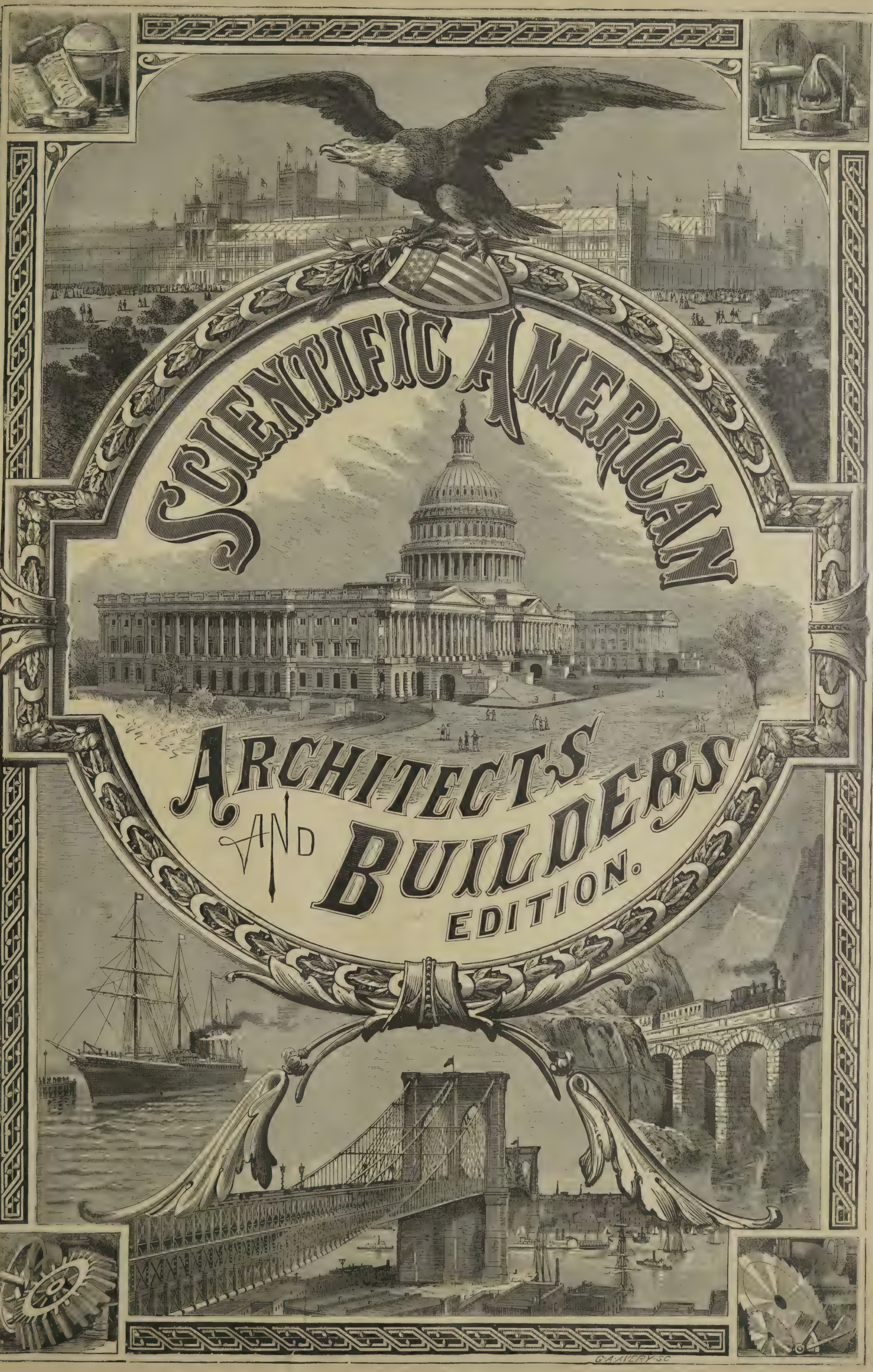

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SCIENTIFIC AMERICAN

ARCHITECTS AND BUILDERS EDITION.

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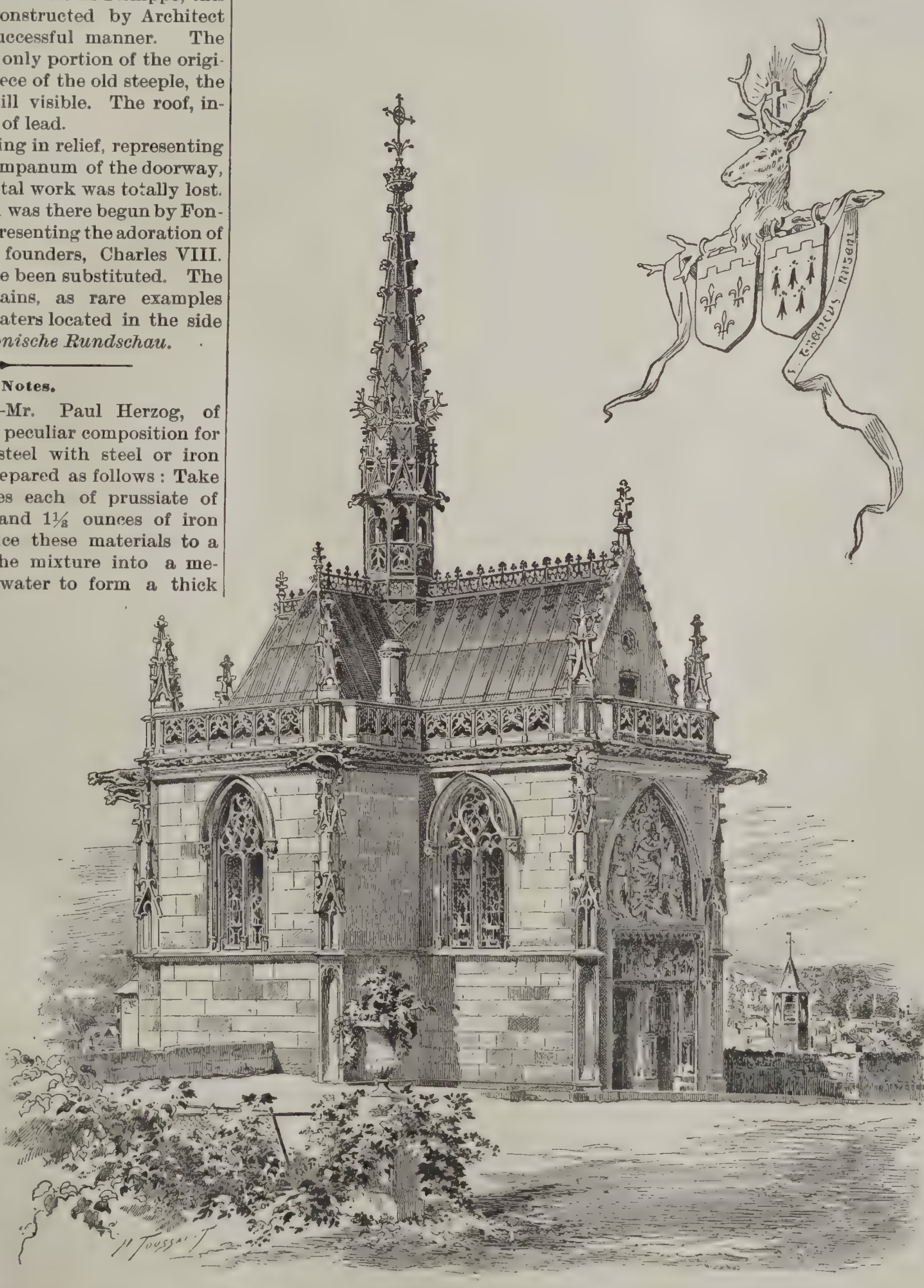
CASTELLATED CHAPEL OF AMBOISE.

The chapel of Amboise Castle, France, restored by Architect Ruprich Robert, is one of the finest examples of the late Gothic style of the close of the fifteenth century. Its situation, on the very edge of a rocky precipice 150 ft. in height, adds to the charm of its general appearance.

After an unsuccessful attempt at restoration by the architect Fontaine, in the time of Louis Philippe, this chapel has been lately reconstructed by Architect Robert in a suitable and successful manner. The roof of the chapel is new, the only portion of the original that remains being a piece of the old steeple, the octagonal form of which is still visible. The roof, including its ornamentation, is of lead.

Above the magnificent carving in relief, representing St. Hubert's Hunt, is the tympanum of the doorway, of which the artistic ornamental work was totally lost. In place of the window which was there begun by Fontaine the groups in relief—representing the adoration of the Virgin and child by the founders, Charles VIII. and Anna von Bretagne—have been substituted. The interior of the chapel contains, as rare examples of those ancient times, two heaters located in the side walls of the nave.—*Architektonische Rundschau.*



THE CASTELLATED CHAPEL OF AMBOISE.—RUPRICH ROBERT, ARCH.—[See pp. 88 and 89.]

Industrial Notes.

Welding Steel and Iron.—Mr. Paul Herzog, of Peterswaldau, has devised a peculiar composition for facilitating the welding of steel with steel or iron with iron. The mixture is prepared as follows: Take 24 ounces of borax, 2¼ ounces each of prussiate of potash and sal ammoniac, and 1⅛ ounces of iron filings free from rust. Reduce these materials to a powder in a mortar, put the mixture into a metallic crucible, add enough water to form a thick paste, place the crucible over a wood fire, and stir constantly, taking care at the same time that the crucible does not come into contact with the flames. In this way there is obtained a material resembling pumice stone, but exhibiting green and gray tints. The substance is allowed to cool, and after being pulverized is ready for use. With this composition it has been found possible to weld piston rods 25 inches in diameter. — *Chronique Industrielle.*

Soldering at a Low Temperature. — The *Electrician* gives a formula for a soft solder which is capable of so firmly adhering to the surface of metals, glass, and porcelain that it may be used for joining all objects that do not have to support a high temperature. It is prepared as follows: Take copper in powder (prepared by precipitation, through zinc, from a solution of blue vitriol) and mix it, in a cast iron or porcelain mortar, with concentrated sulphuric acid (density 1·85). From 20 to 36 parts of copper are used, according to the hardness that is wanted. To this mixture is added, while constantly stirring it, 70 parts of mercury. When the mixture is homogeneous, the amalgam is to be carefully washed with warm water, in order to remove every trace of acid, and is afterward allowed to cool. At the end of 10 or 12 hours, it will be hard enough to scratch lead. When it is to be used, it must first be heated sufficiently to allow it, when triturated in a mortar, to assume the consistency of wax. Under this plastic form it can be spread over any surface whatever, and will adhere thereto with great tenacity after it has hardened.

Artificial Stone.—Messrs. Meyer & Armack have recently patented some formulas for the manufacture of artificial stones that very satisfactorily imitate granite and marble. They mix one part of very fine cement with two parts of sulphate of barytes, and color the whole with any sort of oxide at will. All colors except pure white can thus be obtained. The composition is marbleized or granitized by stirring through it a mixture of water, cement, and pastes prepared from various colors. The composition is pressed in moulds, and the surfaces of the cast are covered with a liquid composed of ten parts of a lixivium of lime and one part of silicate of potash. Finally, the stones are polished, first with this same liquid, and then, two or three days afterward, with tin putty, flowers of sulphur, and alum.—*Le Genie Civil.*

To Remove Rust from Machinery.—*Chronique Industrielle* gives the following formula for a paste which will remove rust and restore to iron and steel the polish that they originally had: Take of cyanide of potassium 3¾ ounces, grease soap 3¼ ounces, Spanish white 7⅛ ounces, and add sufficient water to them to form a thick paste.

Impressions upon Leather.—The *Journal de l'Academie National* has recently published a report by Mr. Giranden, from which we extract the following notes on the imitating of the skins of various animals, and on the stamping of leather with various designs. The imitation of the skins of the shark, seal, hog, alligator, snake, and other animals by stamping is a new industry. Mr. Burc was the first in France to make imitation alligator skin out of sheep skin. The English and Germans have followed in the footsteps of this gentleman, and have recently been applying his processes to the imitation of skins of Chinese manufacture. The Chinese method is to engrave upon copper plates the design that they wish to reproduce upon the leather. These plates are then juxtaposed, and the leather is stretched over them and hammered until it takes the desired impression. The designs are afterward ornamented with either gold or silver leaf, or with ordinary colors and varnish. This leather, upon which are represented flowers, fruits, birds, and animals of all kinds, is used in the manufacture of boxes, reticules, tobacco pouches, etc. In France the designs are formed by electro metallurgy upon a hollow cylinder. The goat, sheep, or calf skin, after being slightly moistened, is passed between this cylinder and a felt-covered roller, and takes a very faithful impression of the designs upon the former.

Sheep skins that are nearly worthless assume the aspect of the most beautiful morocco under Mr. Burc's rollers. Fifty dozen of them per day can be prepared by two men.

A New Process of Welding.

Mr. William Anderson, of Erith, read a short paper before the British Association "On the Lafitte Process of Welding Metals." With a view to overcome the difficulties in spreading borax or other fluxing materials over the heated surfaces in making welds, M. Lafitte had invented plates, usually consisting of a very pliable wire gauze, on both sides of which the flux, being highly vitrified, is evenly spread. Paper may be also used as a support. In cases of small surfaces it is often sufficient to form a sheet of the flux and metal filings agglomerated together. The plates are simply placed between the surfaces, in place of the powder being sprinkled on, the wire gauze being welded in between the surfaces. A table of tests made was shown on the wall, the results being highly favorable to the system. Mr. Anderson attributed a great part of the success to the much lower temperature at which the welding could be accomplished. Examples of welding by this system were also shown, all of great interest; perhaps the most remarkable was the case of a hammer head, in which a face of tool steel had been welded on to an ordinary hammer head forging. This hammer had been in ordinary shop use for six months. To weld tool steel to iron is certainly a remarkable achievement, and one that marks an era in the history of the smith's handicraft.

FOR stove cement use pulverized clay 8 parts, fine iron filings 4 parts, peroxide of manganese 2 parts, sea salt 1 part, borax 1 part. Pulverize, dry, and mix.

Scientific American.

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No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, OCTOBER, 1886.

THE

Scientific American,

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CONTENTS

Of the October number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

Back Numbers.

At present we are able to supply to new subscribers the back numbers of this journal from its beginning in November last. Each number is accompanied by a sheet of colored plates and a sheet of details.

OUR SHEET OF DETAILS.

Our sheet of details for this month refers to the beautiful cottage of which we gave a colored plate in our August number.

USEFUL HINTS TO INTENDING BUILDERS.

Specifications usually call for a cellar of 7 feet in the clear, between the cement of the bottom and the floor beams above. This height is not sufficient to allow for the *proper setting of the furnace*, unless an excavation is made for the furnace below the level of the cellar bottom. This is objectionable, not only because of the inconvenience thus occasioned in getting out the ashes, but chiefly because this excavation, being the lowest part of the cellar, affords a basin for the collection of any water that may get into the cellar. To avoid this trouble, and for many other reasons, it is better to have the height *7 feet 6 inches* in the clear. This will permit the hot air pipes to go out of the furnace bonnet *at the top* (instead of at the sides), and give them a good inclination upward toward the register boxes. Often they are set on a level or nearly so, in which case the hot air does not easily make its way upward, and its circulation is in consequence slow. The smoke pipe also should have all the elevation possible between the furnace and the chimney, to insure a good draught.

The 6 inches added to the height of the cellar does not much increase the cost, while it in every way enhances the value of the house; giving better ventilation, and affording sufficient height for the hanging shelves in the vegetable cellar, etc.

While the foundation wall is being built is the time to leave the holes required for the drain pipes, sewer pipes, etc. Often the mason, for his convenience, pays no attention to these, and, in consequence, the plumber, when he comes to work, must *knock* the needed holes through the wall, to the considerable damage thereof; for these openings are seldom afterward properly filled up solid as the original wall, but instead are *merely stopped up* so as to show a finish on the inside, remaining ever afterward convenient inlets for surface water from the outside, after heavy rains. All these apparently little things done at the *proper time* render the work well done, and save much extra cost, for it often takes more time to pull down work to correct an error than it would have taken to have done it right at the first. Avoid always, if possible, *omissions* as much as *mistakes*, for, in building as in morals, sins of *omission* are often as costly as those of *commission*.

GRAINING AS A DECORATION.

To the Editor of the Scientific American:

In your September number of the ARCHITECTS AND BUILDERS edition, on page 48, you have an article on "Decoration," by a contributor signing himself H. S. J., in which he advises your readers against graining, which he stigmatizes a "sham," and this because it offends something which he imagines to be a law of artistic taste.

Perhaps I am not so cultured in artistic taste as your contributor, but I have always held the idea that the nearest approach to the artistic was that in which the most convenient, durable, and effective was reached. If this is so, undoubtedly graining cannot be anything but very artistic, for what system of decoration have we which can be applied so readily, which is so convenient for all kinds and descriptions of rooms, and which looks so well or lasts so long as graining? I am supposing that the graining is well executed and is not a mere daub, and I contend then—and I am sure that many of your readers will agree with me—that graining cannot be excelled. As to its being a "sham," I utterly fail to find the smallest justification for the word. Graining is graining, and pretends to be nothing else, and it is, therefore, no more a sham than plain paint.

Your contributor recommends the use of plain colors in decoration. I am fully aware that excellent results may be sometimes obtained by their use, but they possess so many serious disadvantages from which graining is wholly free that, in my mind, there cannot be a doubt as to the superiority of the latter. With plain colors it is generally very difficult to obtain satisfactory tints to harmonize with the paper. I remember a case in which, for the sake of variety, I intended to have a dining-room painted in plain colors, and, although experienced at the work, I was two whole days trying to get satisfactory colors. The paper was of the variety known as "Japanesque," and was, perhaps, a bad choice for the room. But, however that may have been, I know that after trying all kinds of shades and tints, which seemed to either give the room the coldness and repellent air of an ice-house or, on deeper colors being used, to make it so hot-looking as to be uncomfortable, I had eventually to settle the matter by having the room grained, and, being fortunate in having a careful and painstaking grainer, the result was perfectly satisfactory.

Another objection to the use of plain colors lies in the fact of the quickness with which they lose their tints, while their delicacy leaves them liable to show the slightest scratch or finger mark, so that generally, in two to three years, a room has to be redecorated, whereas graining improves greatly with age, attaining a beautiful mellow tint; it will stand rough usage far better than plain colors, is more economical, and, with an occasional coat of varnish, will last for years.

Impartially considered, and with these facts before him, will H. S. J. still deny the immense superiority of graining over all other systems of decoration?

R. R. S.

A Test of Spiral Screw Drivers.

Knowing that spiral screw drivers are comparatively new in their mode of working, and not well known by the greater number of mechanics, to whom they may be of great use, I will tell what I have learned of their capabilities by a very thorough test.

The "Olson's" spiral screw driver is well made, and has a brass body and steel blade and "pinion," or "follower." When fully extended, it is 19 inches long, and when closed, 12¼ inches long. The "spiral" is covered at all times, and presents no oiled surface to view. The spiral groove is cut in the inside of the brass body. One *full* thrust gives the blade 3½ complete revolutions. The blade has a good point, that is not liable to slip out of the nick in the screw. The handle is of applewood. It is necessary, when driving screws *overhead*, to grasp the blade gently, near the joint, with one hand, so as to extend the blade.

When closed, it may be used like a common driver to drive or draw screws. "Allard's" spiral screw driver is well made of brass and steel, and has a rosewood handle.

Four spiral grooves are cut in the outside of the blade. The pinion or follower, instead of being attached to the upper end of the blade, as is the Olson's, is in the lower end of the brass body. It has a thread cut in it to fit the grooves in the blade, and cogs or lugs on its upper side, which engage with similar ones on the main stock, thus revolving the blade when pressure is put upon the handle. Its maximum length is 17¼ inches, and its minimum length is 11¾ inches. It is capable of giving a screw 3¼ full revolutions at each thrust.

The blade is made of steel, a little more in diameter than that used in Olson's, and so is not made weak by cutting the grooves in it.

The blade is tapered well back from the point, and is so shaped that it sticks to the screw head well. Closed, it will drive or draw screws.

In overhead work it is necessary to use both hands.

Reid's lightning brace is 29 inches long when fully extended, and when closed it measures 18 inches. It is very long, but has great power. The body is of brass, nickel plated, and has a handle like the head of a bit brace, and immediately below this is a loose head, the two acting as a tight and loose pulley. The shank is similar in form to a piece of square, twisted lightning rod, and at its lower end is a socket, with snap catch for square shanked bits, drills, or screw drivers; and just above this socket a loose handle has a bearing, by which additional pressure may be applied. It gives a screw 4¼ full turns at each thrust. It will drive a screw with great power, but needs lots of room. By pressing firmly on the lower handle with the left hand, and pulling backward with the right, screws may be drawn very quickly. This tool, too, may be closed, and then used as a common screw driver to drive or draw screws. It gives the best results when used with both hands. The handles are made of cocobolo wood, I think. It has no ratchets or pinions.

The Chicopee automatic drill is a novel tool, having a right hand and a left hand spiral groove cut in its steel shank. Unlike the others, it is at all times of the same length. On this shank is fitted a sliding handle, in which are right and left ratchets, so arranged that a down and up motion of the handle gives a continuous forward motion to the tool.

The tool, including screw driver bit, is about 16 inches long. It will *drive* screws very fast, owing to the fact that the screw is driven with up as well as down stroke.

This tool, as its name implies, is intended especially for drilling, but may be used for driving small screws, and it will drive a screw very fast. It has a steel chuck that will hold tools up to $\frac{3}{16}$ in. in diameter. The upper handle is made of iron, is hollow, with screw cap, making a good place for keeping small drills, etc., for use in the tool. At some future time, I hope to speak of spiral tools for boring and drilling.

In my tests of these instruments, the screws used were mostly those made by the Harvey Screw Co., and have a coarse thread that is raised, so that it is considerably larger than the shank of the screw, thus making them run hard. Those driven into pine were just started with a hammer sufficiently to stand alone. The others were driven in cherry that was very hard, and had countersunk holes of the proper depth and size for the screws used. A very large number of screws were driven, and the figures given are the aver-

age number of thrusts required to drive the screws flush.

PINE.

Size screw..	⅜ No. 4	⅝ No. 4	¾ No. 6	⅞ No. 8	1 No. 8
Allard's....	2½	4	4	3½	4 thrusts
Olson's......	2¼	4—	4	3½	4 "
Reid's......	1½	3	3	3—	3 "
Chicopee...	2	3	3½	3¼	3½ "

Size screw..	1¼—10	1½—11	2—11	2¼—10	3—13
Allard's ...	5	4½	8	9¼	½ way in
Olson's......	4¾	4½	8—	9	⅝ way in
Reid's......	3½	3½	5½	7—	7
Chicopee...	½ way in				

It will be noticed that some of the figures are followed by a dash. This is to show that the number is *slightly* in excess of *actual* average.

CHERRY

$\frac{5}{64}$ in. hole, ¾ in. deep, 1 in. No. 8 screw.
Allard's, 3½ thrusts.
Olson's, 3¼ "
Reid's, 2½ "
Chicopee, not quite in.

$\frac{5}{32}$ in. hole, 1⅛ in. deep, 1¼ in. No. 10 screw.
Allard's, 4¼ thrusts.
Olson's, 4⅛ "
Reid's, 3 "

$\frac{3}{16}$ in. hole, 1¼ in. deep, 1½ in. No. 10 screw.
Allard's, 4½ thrusts.
Olson's, 4¼ "
Reid's, 3 "

$\frac{3}{16}$ in. hole, 1¾ in. deep, 2 in. No. 11 screw.
Allard's, 6½ thrusts.
Olsen's, 6 "
Reid's, 5 "

$\frac{5}{32}$ in. hole, 2 in. deep, 2¼ in. No. 10 screw.
Allard's, 9 thrusts.
Olson's, 8¾ "
Reid's, 6¼ "

Some readers may wonder why several *different* lengths of screws require the *same* number of thrusts to drive them. This is owing to the difference in the threads. I consider the spiral screw drivers a *decided success*, profitable alike to workmen and employers.

F. A. RAPPLEYE.

35 Barber St., Auburn, N. Y.

Drawings and Contributions.

To those of our readers who have a mind to employ their leisure time in writing articles for this paper, we would say, the editor will be glad to receive their contributions, and will publish such as are approved.

Articles on practical subjects, aimed to interest and instruct every class of artificers connected with building, are especially desired; and for such articles special arrangements will be made.

Architects and builders who have desirable plans of buildings, which they wish to see illustrated in our columns, are invited to send them in. For colored plates, we need copy colored up as intended. For ordinary illustration, the drawings should be executed in black lines. We aim to give prominent credit to the authors of new designs. Those whose drawings have been issued have derived therefrom much benefit, owing to the very wide publicity thus given to their names and work specimens. It should not be forgotten our Building Edition now has, by far, the largest circulation of any architectural periodical in the world.

Our First Volume.

The first volume of our ARCHITECTS AND BUILDERS EDITION is now ready for delivery, bound in handsome paper covers. Price $1 50 To be had at this office, and of book and news dealers throughout the country. Those who have not seen a half year's collection of our numbers bound together will be surprised at the wealth and variety of contents which the volume presents, as well as at the cheapness of the price.

The volume contains all the numbers of the work from its commencement up to and including June, 1886. It embraces sixteen splendid plates in colors, representing the perspective elevations and plans of various dwellings, all having attractive features; eight large double sheets of details of construction of the same structures; nearly one hundred additional engravings of architectural subjects, public works, buildings, dwelling houses, cottages, etc., with plans; and upward of three hundred other engravings mostly of superior character, illustrative of works and subjects interesting to architects and builders. Including all the separate diagrams and engravings of construction details, the volume presents not far from one thousand illustrations. The reading matter covers a large variety of useful and excellent subjects, interesting to every one. No architect, builder, contractor, engineer, or householder can afford to be without this splendid work. It is beautifully printed, and is by far the cheapest architectural volume ever presented to the public.

MODIFIED SWISS COTTAGE.

Our colored plate this month presents an attractive design for a Swiss cottage by D. W. King, architect, 149 Broadway, N. Y. The cottage has been erected for Charles F. Heath, West New Brighton, N. Y. The cellar is seven feet, the first story nine feet, and the second story eight and a half feet, all in the clear. The foundation walls are of brick eight inches thick, laid in cement, and plastered on the outside to the top of grade; cellar bottom concreted, with necessary drains, etc., to carry off the waste water. Arranged for a portable hot air furnace, with coal room, vegetable cellar, and the usual outside cellar steps and cellar door. The rooms on the first story are parlor, dining room, kitchen, hall, with a pantry, china closet, and store room. One chimney is placed at the side of the house, with a corner fireplace for the parlor, dining room, and front chamber. Sliding doors are placed between the parlor and dining room, so that the rooms may be thrown into one when desired. The pantry is so placed that it is convenient to both the kitchen and dining room.

The pantry doors are hinged to swing both ways, and are self-closing. Kitchen, sink, range, and boiler in the usual way.

In the second story there are two large chambers, one bed room, bath room, and four closets.

The building above the foundations, with the exception of chimneys, is of wood. The side walls are sheathed with dry surfaced hemlock, covered with resin sized paper, and clapboarded to the second story and shingled above the string corner. The roof is shingled upon rough boards. All the outside woodwork of cornices, casing, mouldings, verandas, bay window, steps, etc., is of dry white pine.

The inside walls and ceilings of main rooms are hard finished on two coats of brown mortar; closets are hard finished on one coat of brown mortar. Stair newels and rails of ash, doors of white pine, all other inside woodwork of yellow pine.

Fireplaces faced with pressed prick. Slate hearths.

Bath tub, 14 oz. planished copper.

Water closet, Demarest's patent Supplied with water from the city water works, with necessary waste and ventilation traps, etc., complete.

The house is piped for gas.

Flashings and leaders of I. C. charcoal tin.

The roofs are painted red, shingles on the sides, gables stained with burnt sienna. All other outside woodwork painted two coats rich brown.

Inside woodwork stained and finished with two coats Crockett's preservative. Front door hardware of bronze, all other trimmings of bronzed hardware.

The building is heated by a portable hot air furnace in addition to the open fireplace.

Cost about $2,600. A sheet of details will be given in our November number.

A COTTAGE AT BRIDGEPORT, CONN.

One of our colored plates for this number illustrates an attractive dwelling of moderate cost for Mr. Buckingham Marsh, of Bridgeport, from the designs of Frank D. Nichols, of the office of W H. Worsam, architect, of Burroughs Buildings, Bridgeport, Conn. The cost is moderate, being $1,800

The whole treatment of the design is most satisfactory. A particularly attractive elevation, with a really well arranged plan, makes it one which could be utilized with advantage. It is a difficult matter to obtain a design with the conjoined advantages of a pleasing exterior and a good plan at a low cost like $1,800; and one has only to look around and notice the style of buildings of this class which are as a rule erected, to appreciate the advantages of Mr. Nichols' design.

The construction used in the execution of this design is of the usual kind, but thoroughly substantial. The foundations are of stone, with underpinning of local brick. The body of the house is painted a light olive green in an attractive manner, with the trimmings of a darker tint of the same color picked out with English vermilion. The roof is of Bangor slates, with terra cotta ridge and finials.

The casings and trim internally are all of yellow pine, finished to show plain wood. North Carolina pine is employed for wainscoting kitchen, pantry, lobby, and bath room, relieved by black walnut mouldings. The parlor, dining room, and hall are connected by sliding and folding doors, and each ceiling is neatly paneled and corniced.

The kitchen has a rear entrance, which is fitted up with hat rack, the lobby serving as a protection against the weather on this elevation, which faces north. The pantry is fitted with shelves and cupboard, and with a sink supplied with hot and cold water.

On the upper floor are three good sized bed rooms, two of which are connected by a door, and each being accessible from the hall passage. The bath room is provided with a water closet, a wash bowl, and a bath tub supplied with hot and cold water. The usual objection to the use of inside water closets is met by the location being on the outside, so that on opening a window, direct communication is made with the outer air, and by ventilators which are carried up above the roof.

In the roof is ample space for storage, and, if it were wished, a large bed room could be fitted there without difficulty.

A COTTAGE AT WASHINGTON HEIGHTS, N. Y.

This frame house was designed for one family, and will probably be erected upon Washington Heights this present autumn. It has a cellar under the whole house. The first floor has large and wide hall, parlor, dining room, and kitchen; the second floor, four large bed rooms and a bath room, and three rooms more can be finished off in the attic if desired.

The hall will be finished in ash, the parlor in cherry (natural color), and the dining room will be of oak, stained with a solution of ammonia and water to give it a slightly aged appearance. The kitchen will have no wainscoting to harbor dirt and insects, but the walls and ceiling will have three good coats of white lead and linseed oil paint, and will afterward be coated with enamel paint, so that it will be impervious to moisture, and can easily be kept clean. The bath room will receive the same treatment.

The parlor and dining rooms will each have a hard wood mantel, with tile hearths; and the walls will be covered with a tough parchment wall paper of selected pattern, and the ceilings will be treated with oil frescoing.

The bed rooms on second story will have pinewood mantels, with hot air registers set in, and all trim and base on same floor will be of best white pine, filled, stained, and varnished as directed. It will be noticed that every room has a closet—a great desideratum to the housewife. There is no waste hall room, and the first floor is so arranged that access can be obtained to any room without going through an intervening room. The kitchen connects with the dining room, and is easy of access to other parts of the house, and at the same time it can be shut off so as to exclude all odors of cooking. It will be provided with a large cooking range; a 20 × 36 cast iron sink, with high back and cast iron legs; a 40 gallon boiler; and two ceramic wash trays.

The bath room will have one of Harrison's improved W. C., a 14 inch porcelain wash basin, and a 6 foot bath, made of 14 oz. tinned and planished copper, all with 4 lb. lead safes under them, emptying through ½ inch lead pipes over a sink in cellar.

The cellar will have a cement floor, a bin for ten tons of coal, and a room for stores, etc. The house will be heated with a hot air furnace, which will be sufficient to heat the whole house to 70 degrees of heat Fahrenheit when the outside temperature is at zero. The total cost of the house will be about $4,000.

The plumbing will be of the best, all fixtures trapped and ventilated, and all pipes to be extra heavy.

Mr. A. T. Preyer, of 76 Chambers Street, is the architect, who will furnish any further information that may be desired.

Mr. Preyer pays particular attention to the interior of a house, as to the arrangement of the rooms, the convenience of the occupants, and the perfect sanitary condition of the building.

Colors for Woodwork.

If perfectly new, stain woodwork. The parlor may be stained the color of cherry very suitably, provided it is a large enough and light enough room for such treatment. If it is a small room and not well lighted, it would look better stained to resemble foreign satinwood or old boxwood. Dining rooms look best in old oak of a warm, luminous golden shade or the golden brown of antique oak. Do not attempt to stain in color of walnut, but rather in cherry of natural finish or mahogany. Olive green makes a good background for walnut furniture, and is harmonious with old oak woodwork. If your parlor woodwork is stained like mahogany, sea green or royal blue tiles will be handsome, or buff tiles with blue decorations. Do not get cherry too red. A good way to get this color, if the wood is pine, is to stain it with transported red to a natural cherry tone. With cherry woodwork you can have low-toned yellow walls, terra cotta, dull blue, or olive green or golden olive.

The color of old oak is pleasant for bed-chamber woodwork, and in north rooms terra-cotta paper of an old pink shade is pleasing, and in south rooms olive green of a middling dark and golden shade. Tint ceiling pale, soft olive green.

Galvanic Flannel.

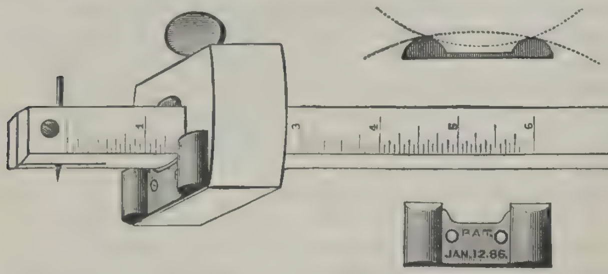
The following novel method of applying an electric current to the body forms the subject of a patent granted to a Spanish gentleman in 1882: The inventor steeps flannel in a bath composed of equal parts of oxide of iron, copper, zinc, and tin mixed in fine powder with weak gum water. The flannel thus takes up a quantity of the metallic oxides, which are excited by the perspiration of the body, which is then subjected to a weak, but constant, electric current.

IMPROVED CARPENTER'S GAUGE.

A device, as simple as it is novel, is illustrated on this page, and by its introduction the uses of an ordinary carpenter's gauge are greatly enlarged. The difficulty of using a common marking gauge on circular work is sometimes partly remedied by the use of a pair of dividers; but it is claimed that the improvement under notice here will even supersede the necessity of this.

The brass face, with two ribs or projections attached to one side of the gauge head (see cut), will enable the owner to run a gauge line with perfect steadiness and accuracy around curves of any degree, and either concave or convex. The opposite side of the gauge head remains flat, and can be used for all ordinary work.

This improvement has been attached to many styles of gauges, as manufactured by the Stanley Rule and



Level Company, New Britain, Conn., and the tools can be had of hardware dealers generally.

Knots in Lumber.

"You would probably be surprised," remarked an observing lumberman in the district the other day, "to see how some of my country orders run. I have customers who won't have a knot imperfection in their lumber, if they can help it, but who will take lumber so shaky it will hardly hold together, without a kick. Indeed, if it looks well, they are very likely to send in another order to be filled out of the same lot. Now, every practical lumberman knows that for ordinary uses, such as lumber is applied to by most country buyers, a good sound knot does not hurt it a particle, while shake is more or less of defect for any purpose. It used to puzzle me to account for this peculiarity on the part of some of my country friends, until I happened, while out on the road one day, to drop into the office of a man whose purchases run to this sort of lumber. I had some particularly good stock, in which the imperfection was chiefly confined to knots. It was sound, and I thought it an especially desirable lot of lumber of the grade. I wanted to send him a car load, but, though I argued diligently with him, he would not buy. Finally, he asked me to go out into the yard and see how his sales ran. I did so, and an hour's observation convinced me that he knew what he wanted better than I did. The grangers who came in to buy would invariably kick about the knots, but show them nice, clean-looking boards that were shaky, and they would take them every time in preference to lumber that was really better in every respect, but the imperfection of which was apparent on the face of it. I marveled no longer at the seeming peculiarity of my friend's taste in lumber, and whenever he sends in his orders now, endeavor to give him what will best satisfy his customers." And, no doubt, there are many among the retail dealers, even, who do not appreciate the comparative worthlessness of shaky stock as compared with that which is only defective because it is knotty, though the knots may be red and sound. Buyers have been known to object vigorously to a really excellent article of dimension which showed a good many knots, and take in lieu of it, at the same price, cleaner-looking, but not nearly so good, stock in which the imperfection was chiefly shake. Unless the difference is carefully pointed out to a user, he is not apt to discover it. A shaky piece of lumber, where the defect is not so great as to entirely destroy its usefulness, makes a very presentable appearance, and this is what users largely depend upon in judging of it. They buy it, and use it, and when it afterward shows a disposition to crack and split, they as likely as not lay the blame upon the paint, or the weather, or some other cause which has nothing in the world to do with it. And when they buy again, they make the same mistake. It would not in many instances be possible to convince such people that they are wrong in their judgment, and perhaps it is not the best policy to try.—*The Lumberman.*

Baldness.

Dr. Hammond's idea that it will be fashionable for the coming man to be quite bald is a comforting one. There are so many million men who are anticipating the style that it is very reassuring to be told that in an advanced civilization, hair on a man's head will not be considered ornamental. Savages have luxuriant hair, but highly cultivated man is becoming more and more a bald-headed creature, and Dr. Hammond is doubly delightful in asserting that the woman of the future will consider a shining pate a noble mark of manly beauty.

FRENCH SANITARY DEVICES FOR DWELLINGS.

As regards inhabited buildings, the quality of the materials employed, the selection and management of the soil and subsoil, the interior arrangements, the heating, the disposal of filth, etc., are so many matters upon which depends the perfect purity of the air breathed during the occupancy of our apartments. Among the conditions inherent to salubrity, there is one which, after a manner, takes the lead over some of the others—we mean the prompt and immediate disposal of all the refuse material of every day life, that is to say, of everything that is subject to putrefaction and fermentation. Now, such substances are especially found in privies, kitchens, and dressing rooms, and these are the parts of the house that it is important to arrange with particular care.

As well known, England has for a certain number of years been making a great stride forward in such matters. In the train of the cholera epidemic which made numerous victims in that country in the middle of this century, her statesmen, at the instigation of several of her most noted hygienists, devoted special attention to the subject of the improvements to be made in the processes of ridding houses of filth, and great efforts in this direction are still being made there. This movement toward hygienic reform afterward reached other countries—especially Germany, Belgium, and the United States; but in France it has scarcely yet begun, notwithstanding the incessant claims that hygiene is the subject of on the part of those who justly believe that the health of the public depends in very great part upon the wholesomeness of dwellings. We know, in fact, as we have already observed, that epidemics arise or are propagated only in unhealthy houses and districts. There is in most cities such and such a quarter, or such and such a house, whose state of insalubrity is notorious, and wherein epidemics never fail to make their appearance first. This was well seen last year in Spain, during the course of the cholera epidemic (the severest of the century), which caused nearly 140,000 deaths there. So great a slaughter could have occurred only in a country where the houses are badly kept and are unhealthy to the highest degree. Whatever be the opinion that is held regarding the genesis and modes of propagation of infectious diseases, these facts cannot be denied; they are the ones that dominate hygiene, and give so great a value to the search for processes for securing the salubrity of dwellings, especially from the particular point of view that just now occupies us.

As has recently been said by Mr. A. Durand Claye, one of the best authorities and most competent of sanitary engineers, the principle to be applied in houses is simple: "As soon as a waste substance is produced, it must be got rid of, and not be allowed to remain in the house. As regards household rubbish, its removal may now be effected in a relatively satisfactory manner.

"The same is not the case with rain and wash water, and with night-soil, the removal of which is usually so badly provided for. What is necessary is sufficient water at each drainage orifice, and then a simple and efficient device for closing it—a hydraulic siphon, that is to say, a proper bend in the waste pipe. Afterward, the general piping in the house should be simple in plan and elevation, communicating broadly at the upper part with the atmosphere, so as at every evacuation to suck in pure, fresh air to permeate the liquid mass, and, through oxygen, to prevent fermentation at the very starting point." Thus, two kinds of apparatus are in all cases indispensable in order to secure salubrity in those parts of a house where waste materials are produced or thrown, to wit, a flushing reservoir and a hydraulic siphon.

Every one knows that the judicious and appropriate use of a certain quantity of water is one of the indispensable elements in the sanitation of houses; but it is very rare that one can make an unlimited disposal of this liquid, and it is not necessary to waste water in order to effect sanitation. So we should endeavor to flush the apparatus and pipes with it often instead of letting it run continuously, as is too often done. The continuous flow, which is in use for certain apparatus, must be converted into an intermittent one of short duration, so as to increase the bulk of water that flows in a given time, and consequently give it a really efficient cleansing power. With this object in view, a large number of flushing apparatus have been devised, either automatic or to be worked by hand. Numbers of these have been successively brought to the attention of builders, architects, and the public. The majority are variants of the automatic annular siphon of Rogers Field. All sorts of mechanical processes have since been proposed, but all possess the drawback of requiring the use of movable parts that are submitted to concussion, and are apt to prove annoying when they get out of order. The least dirt will then suffice to prevent the play of the movable parts. The fact has had to be recognized, too, that the tromp, as applied by Field, requires, for putting it in place, a mathematical precision that workmen rarely reach, and that is easily destroyed even when it has been obtained. So an endeavor has been made to devise apparatus without any mechanism, and capable of effecting the flushing intermittently, and at optional intervals, by means of a siphon primed automatically through an instantaneous fall of water. Messrs. Geneste, Herscher & Carette had on exhibition an apparatus of this kind, which was suggested by the arrangement of Heron's fountain, and which offers over all other similar devices the great advantages of being free from mechanism, of being filled at will, either drop by drop or at quicker intervals, and, once in place, of requiring no special surveillance. The apparatus is shown in Fig. 5.

The hydraulic siphon, which now renders complete every arrangement designed for carrying off waste material, usually possesses an ∞ shape when the way of escape is vertical, and the shape of a half ∞ when it is horizontal. After numerous experiments, these forms have been found to be the most rational, since they offer less opposition to the flow of liquids, and most easily permit of an automatic cleansing of the entire apparatus. Moreover, these siphons have no angles, since they have a circular section throughout their entire length. In the now classical work of Mr. A. Wazon, on the "Technical Principles of Rendering Cities and Houses Healthy," may be found an *expose* of the researches that have shown the marked superiority of this kind of siphon.

The most important thing that can be required of a hydraulic siphon is that it shall offer an insuperable barrier to currents of noxious gases emanating from reservoirs in which evacuations are deposited.

Since the researches made by Wernich, Tyndall, Carmichael, and others, it has been known that this is the case for the most part with S-shaped siphons, a drawing of which may be found in a patent taken out by Alexander Cumming in 1775. But it frequently happens that siphons siphon themselves; that is to say, that, under the action of a suction produced in the main discharge pipe, the supply of water in the siphon runs the risk of being exhausted. Then, as there is no longer anything to check them, the gases from the reservoirs enter the dwelling. Hence the necessity of ventilating the siphon at the bend in the shorter leg, that is to say, of affixing to it at this point a pipe that communicates with the open air. In this way is prevented all suction upon the mass of water that intercepts odors. Fig. 1 shows the comparative effect produced by the passage of water, etc., through an ordinary siphon and a ventilated one. This figure represents an arrangement that was much remarked at the Exposition, where it had been set up by Messrs. Geneste & Herscher. The two siphons were arranged beneath the same reservoir, and every time the water passed, the ordinary siphon siphoned itself, the water descending low enough to allow of a continuous flow of gases, while in the ventilated siphon the cut-off was constantly maintained. Messrs. Geneste & Herscher have not been content with this precaution, but, in the siphons of their make, have taken care to form a sort of pocket at the upper part that contributes to reduce the loss of water in the bend to a minimum, as the level of such water must be as high as possible in intercepting siphons, lest the security that they offer shall prove deceptive. Finally, in order that the ventilating may be readily effected, and that it shall be independent in each siphon, the same manufacturers have conceived the idea of making the ventilating pipe end in a metallic air box placed in the outside wall and containing a movable mica valve which opens for the passage of air every time that a liquid runs through the siphon, and which at once closes when the flow ceases. These important improvements in siphons are the more interesting, in that they are due to the first French manufacturers who have succeeded in offering contractors and plumbers lead siphons at a market price.

The objection has been raised against siphons that they no longer operate after remaining in disuse for some time, owing to the evaporation of the water that they contain. Thus, when a person leaves his apartments for two or three months in the summer, the siphons gradually lose their priming during his absence. This inconvenience, which is rare in practice, can be easily remedied by filling the siphon with glycerine or by allowing a small stream of water to flow during the time that the apartments are not in use. There is at present no better way of preventing a return of unwholesome and dangerous odors to houses. In addition, these apparatus offer the great advantage of enabling us to do away with all those more or less complicated mechanisms that are too often used for carrying off dirt. Our water closets, sinks, etc., are provided with clacks and valves that are inconvenient to manage, and that, as regards hygiene, offer serious disadvantages. If they chance to get out of order (as frequently happens with apparatus in common use, at least), it is often difficult to repair them, and, provided one is at a distance from an inhabited center, the thing becomes almost an impossibility. The result is that during all this time the household directly receives the emanations from the reservoirs into which waste mate-

rials have been thrown. English manufacturers were the first to show us that it was easy to dispense with all such mechanisms. At the Exhibition of Hygiene at London in 1884, in some comparative experiments

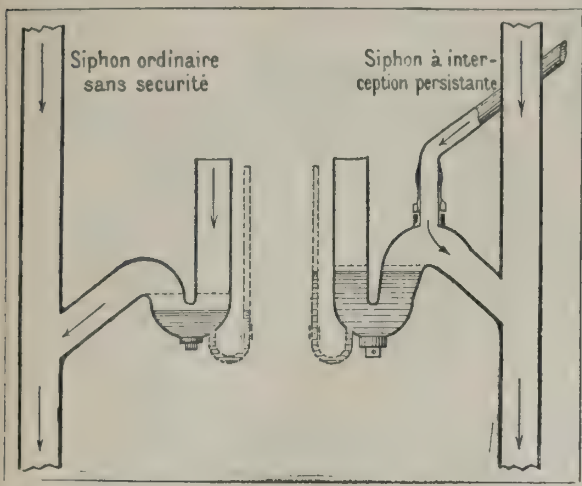


Fig. 1.—AN ORDINARY SIPHON AND ANOTHER OF FRENCH CONSTRUCTION.

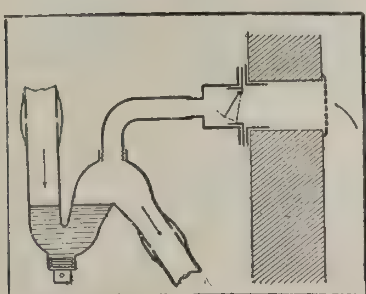


Fig. 2.—FRENCH SIPHON, WITH VENTILATING BOX.

instituted by engineers of the highest merit, it was required that closets, in order to be worthy of reward, should satisfy thirty-seven conditions. At the exposition under consideration there were shown some of the best English apparatus, and also an excellent faience

Fig. 6.—BADLY CONSTRUCTED SINK.

Fig. 7.—PROPERLY ARRANGED WASH BASIN.

basin, without mechanism and with a siphon attached, that Mr. Flicoteaux, a Parisian plumber, had just manufactured for a well-known French house.

From what precedes, it will be seen how great an effort is being made by hygienists to effect the removal of filth from habitations as quickly, simply, and completely as possible. The apparatus, as well as the places where they are situated, should be accessible on every side, so that they may be very easily cleaned; and, moreover, everything surrounding them should be impermeable, tight, and smooth, and no impurity of

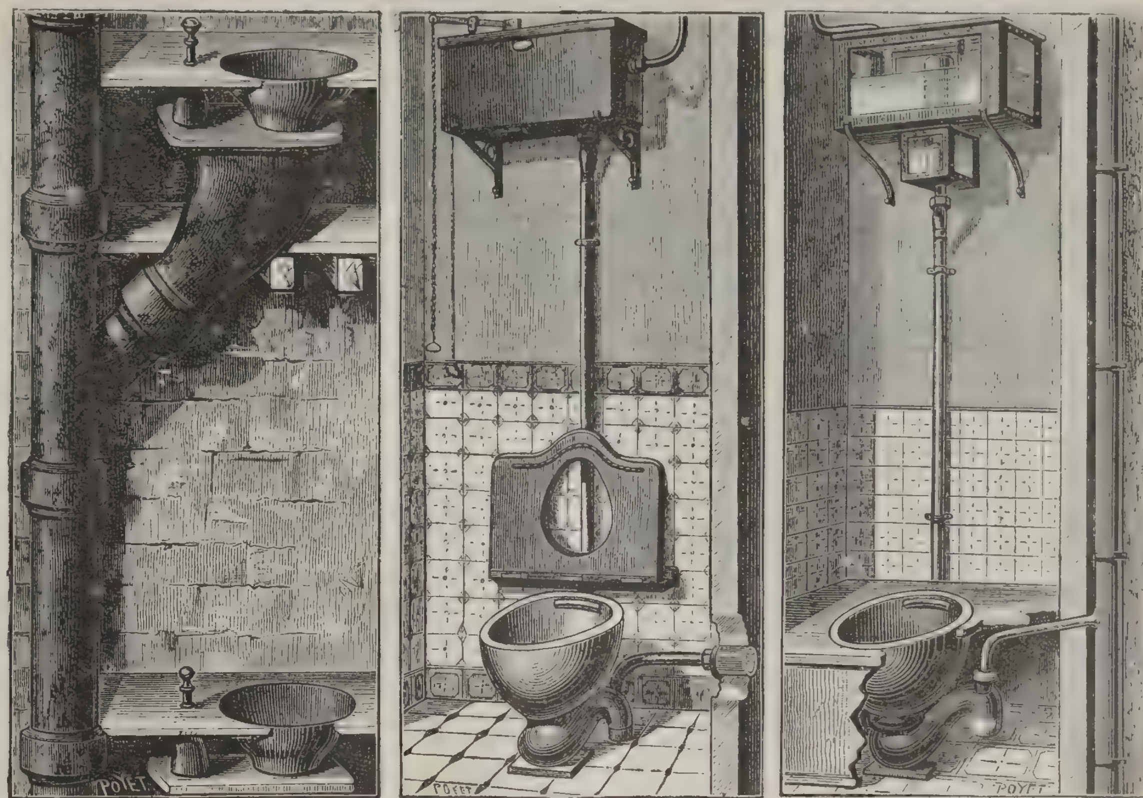


Fig. 3. Fig. 4. Fig. 5.

WATER CLOSETS, WITH IMPROPER (Fig. 3) AND PROPER (Figs. 4 and 5) SANITARY ARRANGEMENTS.

any kind should find a lodging place. Hence the use of glazed tile on the walls, apparatus of faience, and facings of cement.

Great endeavors have been made to find materials that are at once cheap, durable, and absolutely impermeable. Slate quickly gets soiled, and deposits of salts form upon it that are quite difficult to remove, and that are permanent foci of bad odors. Enameled slate is preferable, but is dear, and the same is the case with enameled lava, from which are made tiles, plaques, and the tops of seats of absolute tightness.

At the St. Martin Hospital, glass has been used for this purpose by Messrs. Geneste & Herscher, who constructed some closets there, one of which is represented in Fig. 11. These water closets are lined with glass, the top of the seat is of glass in a single piece, and the flooring is studded with bosses of glass. Such a closet, which is not costly, is very easily cleaned, and is very substantial by reason of the thickness of the glass plates. The same house exhibited some half-cylinders of glass designed for public urinals, and possessing analogous advantages.

Engineer in Chief Durand Claye, with the aid of Mr. Louis Masson, of the Sanitary Service of the Seine, placed before the eyes of visitors to the Exposition specimens of defective arrangements, showing at the same time the improvements that ought to be introduced. In Fig. 3 we see a type of those water closets that are so common in our houses. A simple basin, provided with a valve operated by a rod and knob, is placed over a large cast iron vessel that connects with a discharge pipe that is common to all the stories of the house. There is no flow of water except that effected by the visitor to the closet, and the closet itself is encumbered with pipes around which every kind of filth collects. It is no longer the same when basins without mechanism are employed, such as shown in Figs. 4 and 5. In the former of these we have a flushing reservoir operated by a valve and chain, and in the latter an automatic one, both of which permit of the immediate removal of the ordure, which flows to the discharge pipe after passing through a siphon that is ventilated through a special conduit ending in an air pipe or, better, in an independent aerating box with a mica valve. The apparatus shown in Fig. 4 is provided with a hinged seat that permits of a perfect cleaning of every part.

If it is a question of replacing waste water drains (those horrible boxes into which housekeepers are anxious to throw all dirt, and which serve for all purposes), and to suppress these permanent things of infection, which are too often placed, as shown in Fig. 6, under a window that causes a draught of air into the dwelling, it will be necessary to properly arrange either a sink or a wash basin in the apartment; but both should be surmounted by a cock, and allow the materials carried off by the discharge pipe to reach the latter only through the intermedium of a ventilated siphon, as shown in Figs. 7 and 9.

Such arrangements are becoming more and more necessary where it concerns apparatus that have to serve for a large number of persons, especially when the apparatus cannot be constantly looked after, as happens in public establishments. In Fig. 10 we show one of those water closets called "Turkish," the uncleanness of which is so revolting, and alongside of it one of the glass-lined closets alluded to above (Fig. 11).

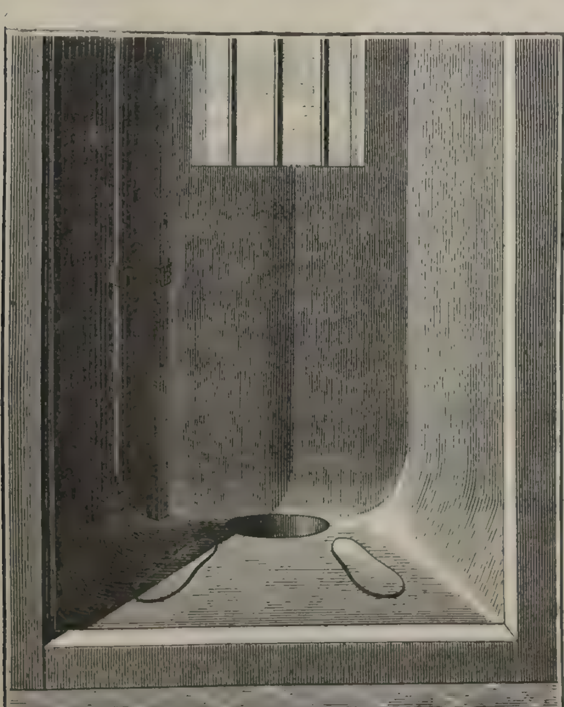


Fig. 10.—PUBLIC WATER CLOSET WITH IMPERFECT SANITARY ARRANGEMENTS.

In this latter, an automatic flushing reservoir expels all the odors at regular intervals, and another reservoir placed at one side causes water to flow from time to time into drains located in front of the seat. A constant and imperceptible aeration is obtained through perforated glass in the windows. A ventilated siphon prevents all reflux of bad odors. In this way are obtained all the conditions that, in the present state of our knowledge, the severest hygienist could exact.—*La Nature.*

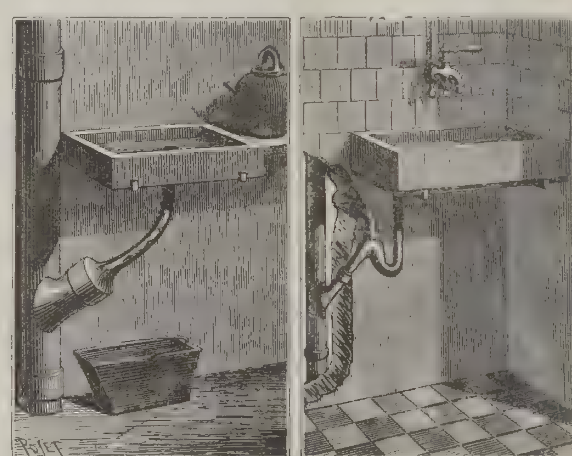


Fig. 8. Fig. 9.

KITCHEN SINKS, SHOWING BAD (Fig. 8) AND GOOD (Fig. 9) PLUMBING.

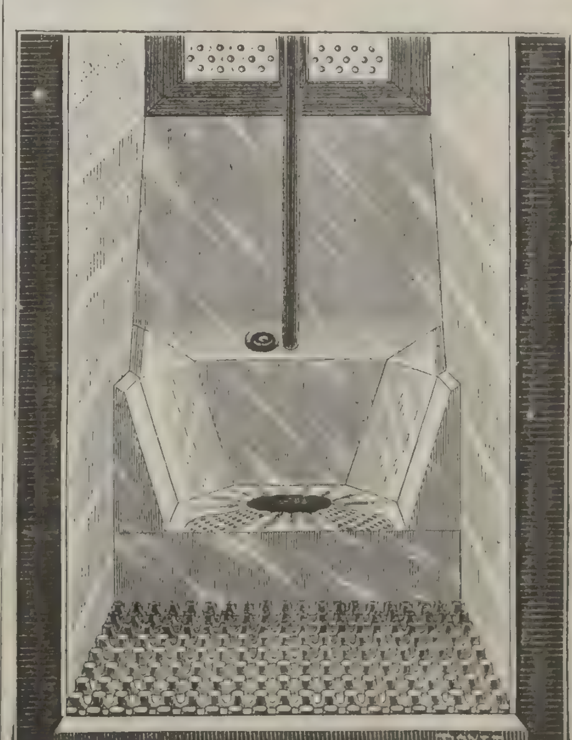


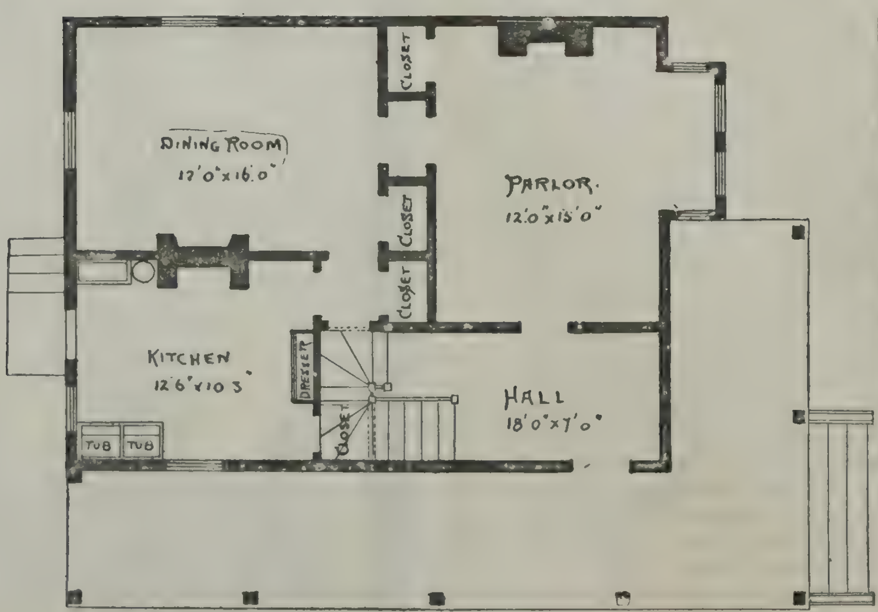
Fig. 11.—PUBLIC WATER CLOSET WITH PERFECT SANITARY ARRANGEMENTS.

REAR ELEVATION

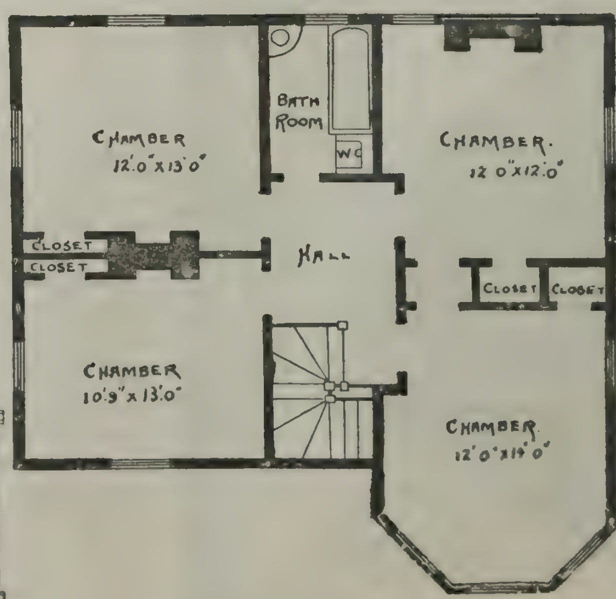
FRONT ELEVATION

SIDE ELEVATION

SIDE ELEVATION



FIRST STORY



SECOND STORY

A COTTAGE AT WASHINGTON HEIGHTS, N. Y.—A. T. PREYER, ARCHITECT.—[See page 71.]

Wages in the Building Trades in New York.

The *New York Star* has compiled. from official sta tistics of various trades, a table showing their actual state on August 31 of this year. We make the following extract :

TRADES AND OCCUPATIONS.	Hours.	Wages per Day.	Av'rage Weekly Wages.	On Strike.	State of Trade.
Bell hangers...	9	$3.50	....	....	Brisk
Bluestone cutters.............	9	4.00	....	....	Brisk
Bricklayers......	9	4.00	....	....	Brisk
Bricklayers' laborers	9	2.50	....	....	Brisk
Cabinet makers...............	8	2.75	$12 00	....	Brisk
Carpenters	9	3.50	....	....	Brisk
Carvers (wood)	8	4.00	....	....	Brisk
Cement masons...............	9	4.00	....	....	Brisk
Encaustic tile layers..........	8	4 00	....	....	Brisk
Electric wire men	9	3.50	....	....	Brisk
Framers.............	9	3.25	....	......	Brisk
Fresco painters	8	4.00	....	... .	Brisk
Gas fitters..................	9	3.50	....	....	Brisk
Granite cutters	8	4.00	....	....	Brisk
Housesmiths.................	9	3.00	....	... .	Brisk
Lathers.....................	9	3 50	....	....	Brisk
Painters....	9	3.50	....	....	Brisk
Paper hangers...............	Irreg.	4 00	....	....	Brisk
Plasterers	9	4.00	....	....	Brisk
Plasterers' laborers	9	2.75	....	....	Brisk
Plumbers....................	9	3.50	....	....	Brisk
Roofers (tin and slate)	9	3.50	....	....	Brisk
Stair builders.....	9	3.50	....	....	Brisk
Steam fitters	9	3.50	.... . .	....	Brisk
Stone masons.........	9	4.00	....	......	Brisk
Tin and sheet iron workers....	9	3 00	.. ....	....	Brisk
Varnishers.............. ..	9	2.50	....	.. ....	Brisk
Wood turners	8	3.00	....	....	Brisk

Masonry Conversion Tables.

BY C. POWELL KARR, C.E.

In the calculation of the cubic contents of masonry on public work, the standard of measurement, of work done and paid for, is the cubic yard To facilitate the conversion of cubic feet, inches, and parts of an inch into cubic yards, has been the object in compiling these tables. They have been thoroughly tested in computing the cubic contents of a large part of the cut stone masonry of the new Croton aqueduct. A simple decimal system of values, in lineal measurements. has been adopted to correspond, and be used in connection with, the table of values of inches and parts of an inch in decimal parts of a foot, now in general use among architects and engineers The values in the second column of Tables III. and IV. are taken from the table thus referred to. There is an apparent paradox in ascribing to lineal feet cubic values, in applying the tables, but the lineal value, so used, may be considered the co-ordinate, or length of one edge, of a cubical body whose other co-ordinates are unity.

In Tables I. and II., all values are lineal. In Tables III. and IV., the dimensions in the first two columns are lineal, but in applying them for purposes of computation, all of these lineal dimensions are assigned cubic values; and the fifth decimal place in the columns of feet, in every case, is assumed to be zero. In Table V., the inches in the first column are understood to be twelfths feet; thus, one foot three inches signi fies one and three-twelfths feet, or equivalent to one and one-quarter cubic feet.

In calculating the tables, the following principles of approximation have been observed: The final figure in every column has been increased by one whenever the ensuing number proved to be five or greater, and results should be interpreted accordingly. Thus, in Table I., the value of two fourths is eighty-eight one-hundredths of one sixty-fourth of one inch; but, in accordance with the above rule, and to make its value practically available, it is written simply one sixty-fourth of one inch. The application of the tables, in computing the contents of a stone, is simple, and can be understood readily from the following example :

The lineal dimensions of a stone are 3 ft. 1 in. by 3 ft. 2 in. by 2 ft. 3 in. Required, the number of cubic yards in the stone? There are three methods of obtaining the cubic feet, and all three methods will be given.

First method, by decimals : By the table which gives the values of an inch. and its parts in decimal parts of one foot, we have 3 ft. 1 in. = 3·0833 ft.; 3 ft. 2 in. = 3·1667 ft.; and 2 ft. 3 in. = 2·25 ft. Hence, 3·0833×3·1667 ×2·25=21·96874 cu. ft. Now, 21·96874 lineal feet = 21 ft. 11⅝ in.

By Table V...........21' 11" = ·811730 cu. yds.
" " III........... ⅝" = ·001930 "

Hence, 21' 11⅝" = ·813660 "

Second method, by fractions :

3 ft 1 in. = $3\frac{1}{12}$ ft. = $\frac{37}{12}$ ft.; 3 ft. 2 in. = $3\frac{2}{12}$ ft. = $\frac{38}{12}$ ft.; and 2 ft. 3 in. = $2\frac{3}{12}$ ft. = $\frac{27}{12}$ ft. Now, $\frac{37}{12}\times\frac{38}{12}\times\frac{27}{12} = \frac{37962}{1728}$ = 21·9687 ft. = 21' 11⅝" = ·81366 cu. yds., as in first method.

Third method, by duodecimals :

3' 1" × 3' 2" = 9' 9" 2''', and this multiplied by 2' 3" gives 21' 11" 7''' 6''''.

$$\left.\begin{array}{l}\text{Now by Table I., } 6'''' = \frac{3}{64}'' \\ \text{" " II., } 7''' = \frac{37}{64}\end{array}\right\} = \tfrac{5}{8}'' = \cdot 00193 \text{ cu yards.}$$

" " V., 21' 11" = ·81173 "

Hence, 21' 11" 7''' 6''''= ·81366 "

To prove the result thus obtained, divide 21·9 874 cubic feet by 27, and we obtain ·813657+, but according to the rule we increase the figure in the fifth decimal place by one, and we have 81366, the same as before.

In stones having battered faces, whose dimensions are given in fractions of an inch below an eighth, it is quite necessary to reduce every dimension to its decimal part of one foot. Where all the dimensions are whole numbers, either the second or third method is preferable The tables eliminate the division by 27 to reduce feet to yards, and cover all calculations from one sixty fourth of one inch to one cubic yard, the unit. Table V. has been carefully checked by the results of computations of hundreds of stones, and it is believed to be without error to the fifth decimal place.

MASONRY CONVERSION TABLES.

TABLE I.

Conversion of Fourths into Inches.

Ft.	Ins.	3ds.	4ths.	Ins.	Ft.	Ins.	3ds.	4ths.	Ins.
0	0	0	1	0·44-64	0	0	0	7	3-64
0	0	0	2	1-64	0	0	0	8	1-16
0	0	0	3	1-64	0	0	0	9	1-16
0	0	0	4	1-32	0	0	0	10	5-64
0	0	0	5	1-32	0	0	0	11	5-64
0	0	0	6	3-64	0	0	0	12	5-64

TABLE II.

Conversion of Thirds into Inches.

Ft.	Ins.	Thirds.	Inches.	Ft.	Ins.	Thirds.	Inches.
0	0	1	5-64	0	0	7	37-64
0	0	2	11-64	0	0	8	43-64
0	0	3	1-4	0	0	9	3-4
0	0	4	21-64	0	0	10	53-64
0	0	5	27-64	0	0	11	59-64
0	0	6	1-2	0	0	12	1

TABLE III.

Conversion of Fractions of an Inch into Feet and Cubic Yards.

Ins.	Ft.	Cu. yds.	Ins.	Ft.	Cu. yds.
1-64	·0013	·000048	33 64	·0432	·001600
1-32	·0026	·000096	17-32	·0443	·001640
3-64	·0039	·000144	35-64	·0456	·001689
1-16	·0052	·000193	9-16	·0469	.001737
5-64	·0065	·000241	37-64	·0482	·001785
3-32	·0078	·000289	19-32	·0495	·001833
7-64	·0091	·000337	39-64	·0508	·001881
1-8	·0104	·000385	5-8	·0521	·001930
9-64	·0117	·000433	41-64	·0534	·001978
5-32	·0130	·000481	21-32	·0547	·002026
11-64	·0143	·000530	43-64	·0560	·002074
3-16	·0156	·000578	11-16	·0573	·002122
13-64	·0169	·000626	45-64	·0586	·002170
7-32	·0182	·000674	23-32	·0599	·002219
15-64	·0195	·000722	47-64	·0612	·002267
1-4	·0208	·000770	3-4	·0625	·002314
17-64	·0221	·000819	49-64	·0638	·002363
9-32	·0234	·000867	25-32	·0651	·002411
19-64	·0247	·000915	51-64	·0664	·002459
5-16	·0260	·000963	13-16	·0677	·002507
21-64	·0273	·001011	53-64	·0690	·0 2556
11-32	·0286	·001059	27-32	·0703	·002603
23-64	·0299	·001107	55-64	·0716	·002652
3-8	·0312	·001156	7-8	·0729	·002700
25-64	·0326	·001207	57-64	·0742	·002748
13-32	·0339	·001256	29-32	·0755	·002796
27-64	·0352	·001304	59-64	·0768	·002844
7-16	·0365	·001352	15-16	·0781	·002892
29-64	·0378	·001400	61-64	·0794	·002940
15-32	·0391	·001448	31-32	·0807	·002989
31-64	·0404	·001496	63-64	·0820	·003037
1-2	·0417	·001544	1"	·0833	·003085

TABLE IV.

Conversion of Inches into Feet and Corresponding Cubic Yards.

Inches.	Feet.	Cubic yds.	Inches.	Feet.	Cubic yds.
1	·0833	·003085	7	·5833	·021604
2	·1667	·006174	8	·6667	·024693
3	·2500	·009259	9	·7500	·027778
4	·3333	·012344	10	·8333	·030863
5	·4167	·015433	11	·9167	·033952
6	·5000	·018519	12	1·0000	·037037

TABLE V.

One cubic foot to one cubic yard.

Conversion of feet and inches into decimal parts of a cubic yard.

Ft.	In.	Cu. yds.	Ft.	In.	Cu. yds.	Ft.	In.	Cu. yds.	Ft.	In.	Cu. yds.
1	0	·03704	1	6	·05556	2	0	·07407	2	6	·09259
1	1	·04012	1	7	·05864	2	1	·07715	2	7	·09568
1	2	·04321	1	8	·06173	2	2	·08025	2	8	·09877
1	3	·04630	1	9	·06481	2	3	·08333	2	9	·10185
1	4	·04938	1	10	·06790	2	4	·08641	2	10	·10494
1	5	·05247	1	11	·07099	2	5	·08951	2	11	·10803
3	0	·11111	3	6	·12963	4	0	·14815	4	6	·16667
3	1	·11420	3	7	·13271	4	1	·15123	4	7	·16975
3	2	·11729	3	8	·13579	4	2	·15432	4	8	·17284
3	3	·12037	3	9	·13889	4	3	·15741	4	9	·17593
3	4	·12346	3	10	·14197	4	4	·16049	4	10	·17901
3	5	·12654	3	11	·14506	4	5	·16358	4	11	·18210
5	0	·18519	5	6	·20370	6	0	·22222	6	6	·24074
5	1	·18827	5	7	·20679	6	1	·22531	6	7	·24383
5	2	·19136	5	8	·20988	6	2	·22840	6	8	·24691
5	3	·19444	5	9	·21296	6	3	·23148	6	9	·25000
5	4	·19753	5	10	·21604	6	4	·23457	6	10	·25309
5	5	·20062	5	11	·21914	6	5	·23766	6	11	·25617
7	0	·25926	7	6	·27778	8	0	·29630	8	6	·31481
7	1	·26233	7	7	·28086	8	1	·29938	8	7	·31790
7	2	·26543	7	8	·28395	8	2	·30247	8	8	·32099
7	3	·26852	7	9	·28704	8	3	·30556	8	9	·32407
7	4	·27160	7	10	·29012	8	4	·30865	8	10	·32716
7	5	·27469	7	11	·29321	8	5	·31173	8	11	·33025
9	0	·33333	9	6	·35185	10	0	·37037	10	6	·38889
9	1	·33642	9	7	·35494	10	1	·37346	10	7	·39197
9	2	·33951	9	8	·35803	10	2	·37654	10	8	·39506
9	3	·34259	9	9	·36111	10	3	·37963	10	9	·39815
9	4	·34568	9	10	·36420	10	4	·38271	10	10	·40123
9	5	·34877	9	11	·36729	10	5	·38580	10	11	·40432
11	0	40741	11	6	·42593	12	0	·44444	12	6	·46296
11	1	·41049	11	7	·42901	12	1	·44753	12	7	·46605
11	2	·41358	11	8	·43210	12	2	·45062	12	8	·46914
11	3	·41667	11	9	·43519	12	3	·45370	12	9	·47222
11	4	·41975	11	10	·43827	12	4	·45679	12	10	·47531
11	5	·42284	11	11	·44136	12	5	·45988	12	11	·47840
13	0	·48148	13	6	·50000	14	0	·51852	14	6	·53704
13	1	·48457	13	7	·50309	14	1	·52160	14	7	·54012
13	2	·48766	13	8	·50617	14	2	·52469	14	8	·54321
13	3	·49074	13	9	·50926	14	3	·52778	14	9	·54630
13	4	·49383	13	10	·51234	14	4	·53086	14	10	·54938
13	5	·49691	13	11	·51543	14	5	·53395	14	11	·55247
15	0	·55556	15	6	·57407	16	0	·59259	16	6	·61111
15	1	·55864	15	7	·57716	16	1	·59568	16	7	·61420
15	2	·56173	15	8	·58025	16	2	·59877	16	8	·61729
15	3	·56481	15	9	·58333	16	3	·60185	16	9	·62037
15	4	·56790	15	10	·58642	16	4	·60494	16	10	·62346
15	5	·57099	15	11	·58951	16	5	·60803	16	11	·62654
17	0	·62963	17	6	·64815	18	0	·66667	18	6	·68519
17	1	·63271	17	7	·65123	18	1	·66975	18	7	·68827
17	2	·63580	17	8	·65432	18	2	·67284	18	8	·69136
17	3	·63889	17	9	·65741	18	3	·67593	18	9	·69444
17	4	·64197	17	10	·66049	18	4	·67901	18	10	·69753
17	5	·64506	17	11	·66358	18	5	·68210	18	11	·70062
19	0	·70371	19	6	·72222	20	0	·74074	20	6	·75926
19	1	·70679	19	7	·72531	20	1	·74383	20	7	·76234
19	2	·70988	19	8	·72840	20	2	·74691	20	8	·76543
19	3	·71296	19	9	·73148	20	3	·75000	20	9	·76852
19	4	·71605	19	10	·73457	20	4	·75309	20	10	·77160
19	5	·71914	19	11	·73766	20	5	·75617	20	11	·77469
21	0	·77778	21	6	·79630	22	0	·81481	22	6	·83333
21	1	·78086	21	7	·79938	22	1	·81790	22	7	·83642
21	2	·78395	21	8	·80247	22	2	·82099	22	8	·83951
21	3	·78704	21	9	·80556	22	3	·82407	22	9	·84259
21	4	·79012	21	10	·80864	22	4	·82716	22	10	·84568
21	5	·79321	21	11	·81173	22	5	·83025	22	11	·84877
23	0	·85185	23	6	·83037	24	0	·88889	24	6	·90741
23	1	·85494	23	7	·87346	24	1	·89197	24	7	·91049
23	2	·85803	23	8	·87654	24	2	·89506	24	8	·91358
23	3	·86111	23	9	·87963	24	3	·89815	24	9	·91667
23	4	·86420	23	10	·88272	24	4	·90123	24	10	·91975
23	5	·86729	23	11	·88580	24	5	·90432	24	11	·92284
25	0	·92593	25	6	·94444	26	0	96296	26	6	·98148
25	1	·92901	25	7	·94753	26	1	·96605	26	7	·98457
25	2	·93210	25	8	·95062	26	2	·96914	26	8	·98766
25	3	·93519	25	9	·95370	26	3	·97222	26	9	·99074
25	4	·93827	25	10	·95679	26	4	·97531	26	10	·99383
25	5	·94136	25	11	·95988	26	5	·97840	26	11	·99691

Crater Lake, Oregon.

A party sent out under the command of Captain Clarence E. Dutton, of the army, has succeeded in making a complete survey of Crater Lake, in Oregon, a body of water whose shores, with the possible exception of one point on the south, have never before been touched by the feet of white men. The party's boats were hauled 100 miles by mule teams, dragged by a detail of soldiers up the snow-clad sides of the ridge which surrounds the lake, and lowered by ropes from the crest to the water, 900 feet below. One hundred and sixty soundings were made, the result of which gave the general character of the lake bottom. Two large submerged cinder cones were found, respectively 800 and 1,200 feet high, the rest of the bottom being flat. Captain Dutton believes this to be the deepest body of fresh water on the continent. The greatest depth attained by the sounding line was 2,005 feet. He writes to Director Powell, of the Geological Survey :

"As regards the origin of the basin, I now have a decided opinion. It has, I think, been formed in much the same way as the great *calderas* of the Hawaiian Islands, by the melting of the foundations of the original mountains, the blowing out of the molten material in the form of light pumice and fine tufa. It cannot have been formed by an explosion, like Krakatoa and Tomboro, for there is no trace of the fragments anywhere in the country round about. But the pumice and tufa which surely emanated from this crater are seen in vast quantities anywhere within a radius of twenty to sixty miles, and in quantities ample to fill the whole vast crater twice over. The age of the crater is wholly post-glacial. I have found at the extreme crest of the wall on the western side splendid examples of glacial striation, while the old moraines are half a mile to a mile below. That the age of the *caldera* cannot be great is evident from the fact that though the walls are crumbling at a very rapid rate, the talus has not only not reached the water surface anywhere, but the sounding discloses little of it at the bottom."

ON the 27th of July a party of engineers and workmen had an excellent opportunity of observing the way in which a thunder cloud discharges its electricity. The *St. James's Gazette* says : "They had just completed the fitting of a lightning conductor at the shelter hut on the Mythen, in Schwyz. A heavy storm was seen approaching from three different points, and they took refuge in the hut. Through a hole in the wall they could see the conductor. From time to time small bluish flames appeared hovering on it; then the lightning flash would be seen descending along, the conductor into the earth, followed almost instantaneously by the thunder crash. More than twenty times they watched the phenomena regularly succeeding each other; then there was an electrical discharge of such violence that there seemed to be a recoil, and two of the party felt the shock from below up to their hips, and one fancied that both his legs were shot off. The men were so terrified that they quitted the hut and descended the mountain amid blinding snow as well as thunder and lightning.

GREENHOUSES FOR FORCING VEGETABLE CROPS.

PETER HENDERSON.

Since "Gardening for Profit" was first published, larger experience of the last twenty years has shown that greenhouse structures for forcing vegetables can not only be erected cheaper when made twenty or twenty-two feet wide, instead of ten or eleven feet as formerly, but from the larger volume of air they contain, which, when once heated, better resists the outer cold, less artificial heat is necessary. So convinced were we of the advantages of the wider structure that, six years ago, we removed all our old eleven-foot houses, covering nearly an acre in glass, and replaced them with greenhouses averaging twenty feet wide by one hundred feet in length. John Hudson, of Bergen Co., N. J., one of the most successful of the market gardeners in the vicinity of New York, constructed six greenhouses the past season, each 150 feet long and 22 feet wide, plans of which are here given. The cost of these greenhouses complete, with ventilating and heating apparatus, benches, etc., was about $10,000, or about $10 per running foot. The structure, as seen in Fig. 1, is very simple.

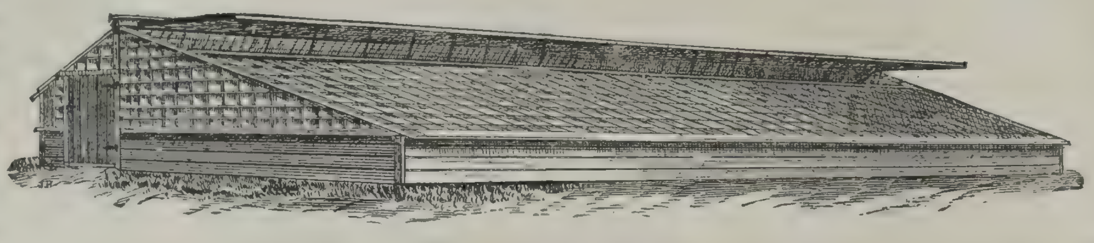


Fig. 1.—VIEW OF FORCING HOUSE.

The walls, front and rear, are constructed of common cedar posts, about five to six inches in diameter, placed four feet apart and sunk three feet in the ground. On the outside of these are nailed rough hemlock boards, upon which a layer of asphalt or tarred paper is tacked, over which is nailed the ordinary weatherboarding. Such a wall will resist cold better than an eight-inch brick wall, and will last twenty-five years if kept painted. A very common error is to build the wooden walls of a greenhouse hollow, and fill up with sawdust. This should never be done, as it is more expensive, and is by no means so good as the plan above given. It will be seen by the engraving, Fig. 2, that these greenhouses are heated with hot water. The six O's in the engraving represent six runs of four inch pipe, which is sufficient to give a night temperature of 45 or 50 deg. when the thermometer is ten below zero, which is a proper night temperature in the winter months for growing such crops as lettuce and radishes. Of course, in the day time, when the sun shines, the temperature of such a house will run 15 or 20 deg. higher; and ventilation should not be given until the temperature reaches 70 deg. The great point to be considered in forcing crops of lettuce or radishes in greenhouses is, if possible, not to let the night temperature exceed 50 deg. Of course, this cannot be helped in the fall months, when the temperature outside is often much higher than 50 deg. at night; but in such cases, during the months of October and November, the ventilating sashes should be left up, so as to keep the temperature at night as low as practicable. Often the entire first crop of lettuce is lost for want of this precaution. Further experience has also taught us the necessity of using larger sized glass. The size most used is 12 by 16, put in the 12 inch way. The object of the larger glass is to obtain the greatest amount of light. In glazing, the method now almost universally adopted is to bed the glass in putty and tack it on top with large glazing points, using no putty on top. The glazing points are triangular, one corner of which is turned down, so that, when it is driven in, it fits against the lower edge of each pane, and prevents it from slipping down. A great mistake is often made in giving the glass too much lap. It should be given just enough to cover the edge of the pane from one-eighth to one-quarter of an inch. If given much more, the water gets between, and cracks the glass when it freezes.

It will be seen that two of the hot water pipes are placed under the front bench. The other four are placed two on each walk. The front bench, four feet wide, is constructed so that it will hold five or six inches in depth of soil; but the middle or main bench, which is thirteen feet wide, requires to be walled up to a height of two feet—see plan—and filled up to the top with soil. The soil best fitted for the growing of lettuce is five parts good, strong, fresh loam to one part well-rotted cow manure. I will give as nearly as I can our manner of operating. The first sowing of lettuce (which is mainly the Boston Market variety), made in the open ground about the 20th of August, will be large enough to be set in greenhouse benches, at six or seven inches apart each way, by the 20th of September, and will, without fire heat, give fine heads by the 1st of November. For second succession, sowings are made still outside, about the 20th of September, to replant the space where the first crop has been cut out by the first week in November. As the season is now getting colder, the crop planted by the 1st of November will not be fit for market until about the Christmas holidays, at which time it usually sells well. For the third crop, to be planted in January, the plants made by the sowing on the 20th of September should be used. This crop, which has to be grown in midwinter, will not be ready, if planted the first or second week in January, until about the 1st of April.

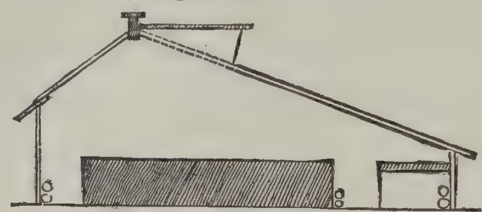


Fig. 2.—CROSS SECTION.

One of the greatest pests in growing is the green fly, or Aphis, and the remedy must be preventive, for if it once gets a foothold on the growing plant, it cannot be destroyed. From its operations being mainly on the under side of the leaf, nothing can reach it; consequently, every germ of it must be destroyed before planting. Tobacco in any form is destructive to it. So, before planting, let the surface of the soil be sown over with tobacco dust, and also let the young plants be rinsed in water wherein tobacco stems have been steeped long enough to give it the color of strong tea. By using these precautions, there is little danger of the lettuce being attacked by the insect, although, as a further measure of precaution, it will be well to strew the plants with refuse tobacco stems, which will make a complete antidote against the Aphis. There is another disease often affecting lettuce, with which, however, it is not so easy to cope. It is first seen by the leaves hardening and spotting brownish red, then gradually decaying toward the center of the plant, until it partly destroys it. The cause seems to be anything that gives the plant a check, any too sudden change of temperature, too much dryness, or too much moisture. There is, I think, no remedy after the disease has once started. So our efforts must be for prevention.

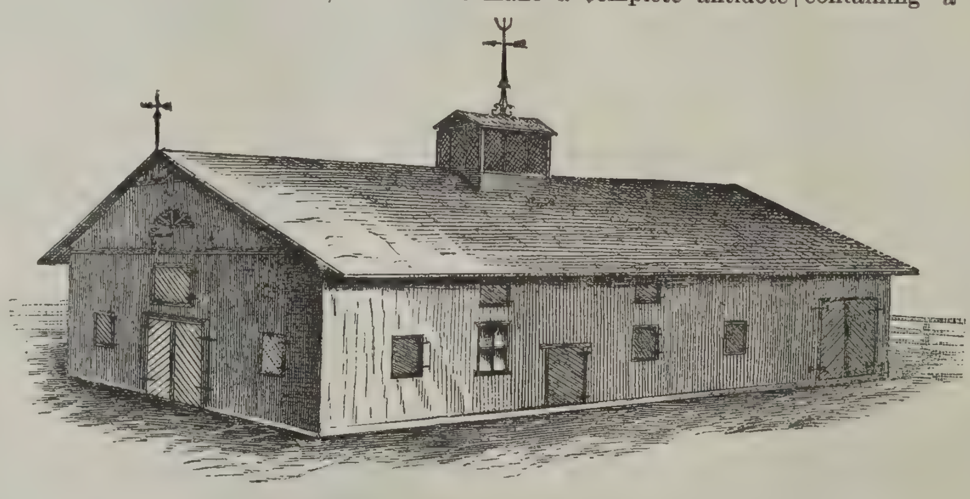
Mr. Hudson has used some of his greenhouses for growing the Scarlet Round radish, which he finds less liable to disease. These are first sown about the first week in October, successive sowings being made on the same ground as each crop is marketed, which, according to the season, is from five to eight weeks from the time of sowing, three crops usually being obtained by the middle of March. The seed is sown thinly in rows, three or four inches apart, and the radishes are thinned out, when an inch high, to two inches between the plants. After the crops of early lettuce and radishes have been marketed (about the middle of March), the benches are again planted with Snowball cauliflower at twelve or fourteen inches apart each way, which is marketed about the end of May, or two weeks before the outdoor crop is ready. Another, and often very profitable, use is made of these forcing greenhouses by packing large clumps of rhubarb or asparagus, lifted so as to leave the soil embedding the roots. These clumps may be set as close as they can be packed, about the middle of December, under the front bench, as they require no light and will be found to be very profitable, the only cost being the roots, which can easily be raised, where ground is plentiful, in the open field by sowing the seed in rows.

It is not easy to estimate the profits on such an investment in forcing greenhouses for vegetable crops, as so much depends on what the market demands. Of course, all the products in such a market as New York are sold at wholesale, and not infrequently pass through four different hands before reaching the consumer; but even thus sold, it is safe to say that, with a fair average culture, such crops at wholesale rates will pay a clear, net profit of 30 per cent annually; while there is but little doubt that, if the consumer could be reached direct, at least twice, if not three times, that amount could be realized. The business is a particularly pleasant one, and has great advantage in all respects over the hotbed system, as one has complete control over the greenhouse temperature, both by night and day, if the heating and ventilating apparatus has been properly constructed. These greenhouses are also well adapted for raising all kinds of vegetable plants. For the past six years nearly all the cabbage, cauliflower, lettuce, and tomato plants have been raised in these greenhouses at far less expense than in the old fashioned hotbeds. When the expense of hot water apparatus cannot be afforded, the same style of greenhouse can be heated by the horizontal smoke flue, costing little more than half as much as the hot water apparatus, which is about one-half the cost of construction.—*Amer. Agriculturist.*

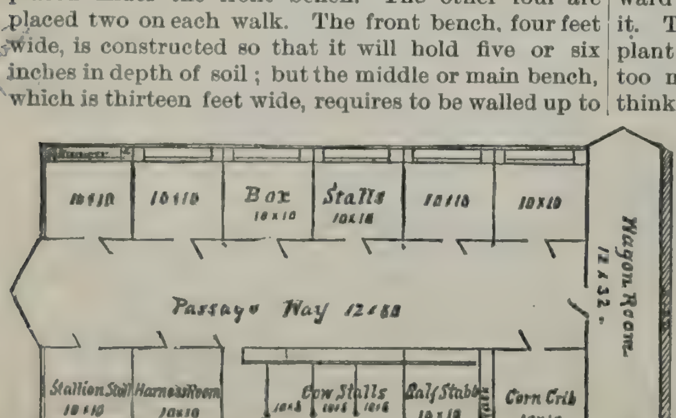
A GENERAL SERVICE BARN.

The accompanying illustrations represent the barn of Mr. S. D. Goff, Clark County, Ky., recently built by Mr. T. T. Templin, who writes us that it is intended for a farm of from 100 to 150 acres, and that it is answering all purposes satisfactorily. Our engraving is from the *American Agriculturist.*

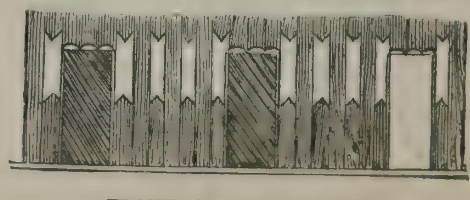
It is 72 feet long, 32 feet wide, and 18 feet high to the eaves. There are six box stalls, 10 by 10 feet, each containing a manger and two feed boxes. All the stalls are wainscoted to the height of 3 feet 6 inches; the upper part is latticework. The harness room is 10 by 10 feet, and from this, stairs lead to the upper floor. From the corn crib a box projects into the passway, so that corn may be taken out without entering the crib. The wagon room is 12 feet wide, and has a feed box and rack running its entire length, so that mules or cows may be sheltered there in stormy weather. On the second floor are bins for oats and bran. A hay fork, which may be moved through the entire length of the building, is used for unloading and mowing hay. The entire cost of this barn was $800, but of course this may vary considerably in different localities, according to the local prices of labor and material.



A KENTUCKY GENERAL SERVICE BARN.



GROUND PLAN OF BARN.



FRONT OF BOX STALLS.

A Simple Method of Fixing Crayon Drawings on Paper.

Prof. F. P. Dunnington, University of Virginia, says: It is frequently desirable to preserve drawings made on the blackboard for purposes of class illustration. All such drawings may be readily made with colored crayons upon unsized paper, and then fixed by passing the paper through a bath of dilute varnish, consisting of one part dammar varnish and twenty-five parts of spirits of turpentine. The paper is then allowed to dry over night, and may be handled and rubbed without blurring the drawing.

Resonance in Rooms.

Every room has a keynote, and if an instrument be sounded on this, it will resound with great force. The continuance of a single sound, and the tendency to confusion in distinct articulation, will depend on several conditions—first, on the size of the apartment; second, on the strength of the sound, or the intensity of the impulse; third, on the position of the reflecting surface; and fourth, on the nature of the material of the reflecting surfaces. In regard to the first of these, the larger the room, the longer time will be required for the impulse to reach the wall along the axis; and if we suppose at each collision a portion of the original force is absorbed, it will require double the time to totally extinguish it in a room of double the size, because, the velocity of sound being the same, the number of collisions in a given time will be inversely as the distance through which the sound has to travel. Again, that it must depend upon the loudness of the sound, or the insecurity of the impulse, must be evident when we consider that the cessation of the reflections is due to the absorption of the walls or irregular reflection, and that, consequently, the greater the amount of original disturbance, the longer will be the time required for its complete extinction. Thirdly, the continuance of the resonance will depend upon the position of the reflecting surfaces. If these are not parallel to each other, but oblique, so as to reflect the sound, not to the opposite but to the adjacent wall, without passing through the longer axis of the room, it will evidently be sooner absorbed. Any obstacle, also, which may tend to break up the wave, and interfere with the reflection through the axis of the room, will serve to lessen the resonance of the apartment. Hence, though the paneling, the ceiling, and introducing a variety of oblique surfaces may not prevent an isolated echo, provided the distance be sufficiently great and the sound sufficiently loud, yet that they do have an important effect in stopping the resonance is evident from theory and experiment. In a room fifty feet square, in which the resonance of a single intense sound continued six seconds, where cases and other objects were placed round the wall, its continuance was reduced to two seconds. Fourthly, the duration of the resonance will depend on the nature of the material of the wall. A reflection always takes place at the surface of a new medium, and the amount of this will depend on the elastic force or power to resist compression, and the density of the new medium. For example, a wall of nitrogen, if such could be found, would transmit nearly the whole of a wave of sound in air, and reflect but a very small portion. A partition of tissue paper would produce nearly the same effect. A polished wall of steel, however, of sufficient thickness to prevent yielding, would reflect, for practical purposes, all the impulses through the air which might fall upon it. The rebound of the wave is caused, not by the oscillation of the wall, but the elasticity and mobility of the air. A single ray of sound, striking against a yielding board, would probably increase the loudness of the reverberation, but not its continuance. —*J. Henry.*

Copying Drawings with the Camera.

The first rule we have to consider consists in examining that the focusing glass of the camera and the camera front are parallel to the drawing board on the easel which contains the drawing. Carefully measuring the distances is highly to be recommended. The focusing glass must be grained with the finest grain. I seldom could find one in the market proper for the purpose of focusing the most delicate parts of a steel engraving, and I grained all my focusing glasses myself with finest emery dust, water, and a perfectly flat surfaced piece of glass. No other than "patent plate" will allow to get the work satisfactorily done.

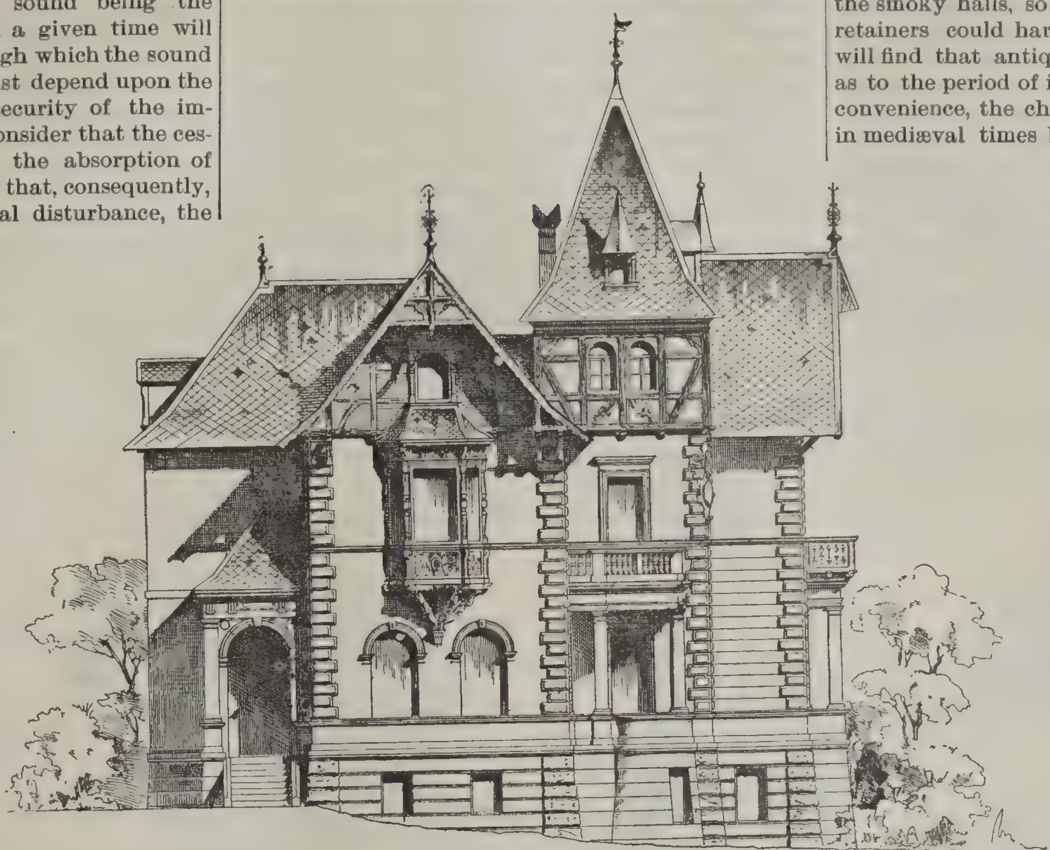
The second thing to be taken into consideration consists in examining the lighting of the drawing. Our readers may be reminded that each elevation, caused by the grain of the paper, will have a surface on one side inclined toward, and on the other side from, the source of light. This effect must be got rid of by having light falling from all sides on the picture. Front light *alone* might cause reflection.

In copying maps and geometrical plans, there is another thing to be carefully attended to. We must use a *rectilinear lens*, which reproduces lines and angles in their original value; the straight line of the original must be a straight one, as well as in the negative, and the right angle must not be altered in any way.—*Litho. and Printer.*

COUNTRY HOUSE AT HIETZING, NEAR VIENNA.

The plans were drawn by Architect R. Feldscharek, Professor in the City Trade School of Vienna.

The whole is a plaster building, and only the balconies and other projections are partly of stone and partly of wood; the gable and the upper part of the tower are framework covered with tiles. The drawing rooms, etc., are provided with hard wood floors and beautiful doors and wainscoting.



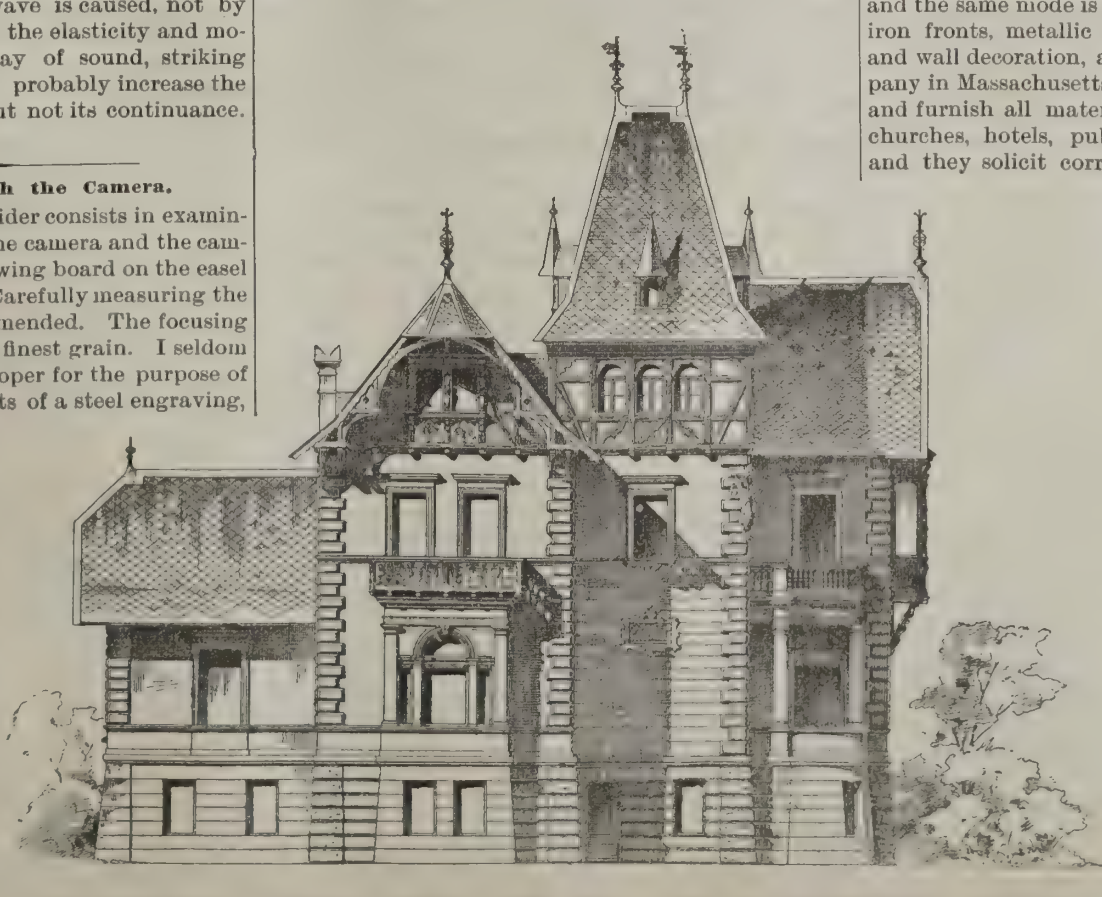
FRONT ELEVATION.

History of the Chimney.

I must not forget to do justice to the chimney shaft. Out of these trivial and uncleanly smoke vents architects have taxed their ingenuity to produce really marvelous objects of high æsthetic value. Of classical interest they can scarcely be said to possess any, for it is very doubtful whether architects of classic times recognized the existence of such a feature. Vitruvius does not even name them. The remains of Herculaneum present not a single example of one; nor do the mosaics, frescoes, or bass-reliefs of antiquity show any indication of one, as far as I know. There is every reason to believe that the only means of escape for the smoke of their fires was through a hole in the roof, like the louvers of mediæval times, so that the "smoke nuisance" we complain of at the present day may lay claim to high antiquity. The very name of the large hall in a Roman's house—atrium—is believed to be derived from this nuisance. "Atrum enim erat ex fumo." The statues in these halls are described by Juvenal and others as "fumosi;" and Vitruvius advises that there shall be no carved work in the interior of winter rooms, as they so soon, he says, get covered with soot. I apprehend that the roof timbers of our old baronial halls must have presented much of the same appearance; and as Horace complains of the "watery eyes" produced by the smoky halls, so our own mailed knights and their retainers could hardly have been better off. You will find that antiquaries are by no means satisfied as to the period of introduction of this great domestic convenience, the chimney, but it was somewhat late in mediæval times before chimneys became very common. Viollet-le-Duc gives us in his "Dictionnaire Raisonné" a good example of one of the thirteenth century, formerly existing in the Abbey of St. Lo, and in England we have examples of still earlier date; but as civilization advanced, and men's domestic habits refined, the chimney became conspicuous. They lavished art upon the decoration of the hearths below, while the chimney above partook of the same feeling, and both gradually grew into favorite objects of design, until, in the sixteenth century, the exuberance of architecture—especially, I think, in France—led to the erection of those enormous and elaborate towers which we see provided for the discharge of smoke at Fontainebleau and very many other places.—*S. Smirke, R.A.*

General Contracting.

In England we have not quite accepted the mode of building by contracting companies. What would be thought, for example, of a manufacturing company offering to design and carry out in sheet metal architectural designs for churches, houses, and other buildings? Such companies exist in the United States. One firm advertises catalogues containing a variety of architectural designs in sheet metal, comprising all sorts of ornaments, statuary, cornices, etc. The class of design illustrated in these catalogues is one which we have been somewhat accustomed to see in the erection of temporary churches and mission rooms. Sheet metal is very largely employed in America for architectural dressings and decorations, or "trimmings," as they are called, and an extensive trade is carried on in the manufacture of cornices, door and window dressings, finials, and roofs. These features are necessarily of a hackneyed type. The cornices are moulded and fixed on wooden brackets, and the same mode is adopted for other features. Cast iron fronts, metallic tile roofs, art tiles for dadoes and wall decoration, are common features. One company in Massachusetts advertises to perform all labor and furnish all materials required to build complete churches, hotels, public buildings, and residences, and they solicit correspondence with those who are desirous to place the construction of any new work under one contract, which shall include all branches connected with the work. The announcement winds up by remarking that the large amount of material used enables the company to quote very close prices. American building journals contain announcements which would cause a shudder to many of our art architects in this country, who view with alarm the employment of metallic decoration and wholesale contracting for building works.—*Building News.*



SIDE ELEVATION.—A GERMAN COUNTRY HOUSE NEAR VIENNA.—R FELDSCHAREK ARCHITECT.

THE longest span of wire in the world is used for a telegraph in India over the river Kistnah, between Bezorah and Sectynagrum; it is more than 6,000 feet in length, and 1,200 feet high.

ST. IGNATIUS COLLEGE, SAN FRANCISCO, CAL.

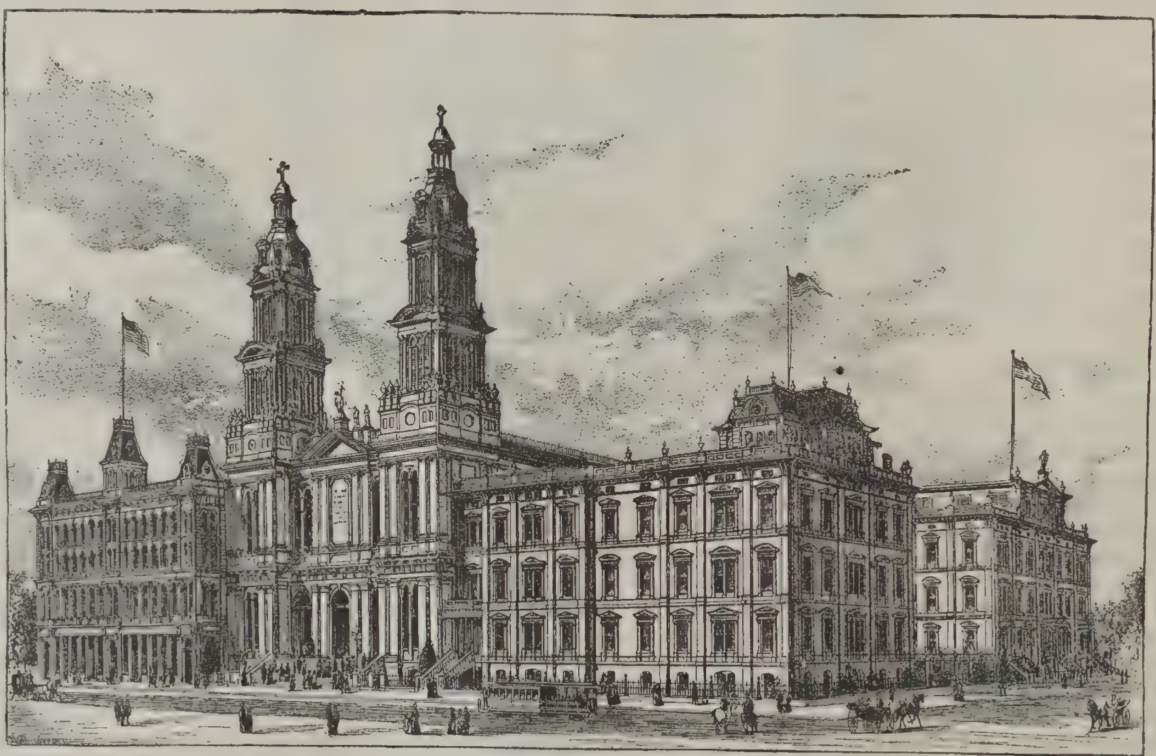
This educational institution, conducted by the Fathers of the Society of Jesus, was opened for the reception of students on the 15th of October, 1855. It was chartered by the State on the 30th of April, 1859, and empowered to confer academical degrees, with "such literary honors as are granted by any university in the United States."

Its location is in one of the most eligible parts of the city, extends over a whole square, bounded by Grove, Franklin, and Hayes Streets and Van Ness Avenue, and it possesses the most ample accommodations and improved conveniences for 1,200 students.

The new college buildings are divided into three principal stories for the three separate departments: the preparatory, the literary and commercial, and the philosophical and scientific.

Besides the required reception rooms and offices, large and lofty halls and stairways, several library rooms and debating halls, distinct play-yards with covered walks and porticoes for the larger and smaller students, the buildings contain a full complement of very capacious school-rooms, well lighted and ventilated and furnished with the most approved modern conveniences. They possess also a large and well-appointed chapel for the religious exercises, and a college hall, 100 × 145 feet internal dimensions, with spacious platform and stage, suitably furnished and arranged for scholastic exhibitions, representations, lectures, and other public exercises.

The scientific department contains lecture rooms for physics and chemistry; a chemical laboratory and an extensive cabinet of physics; rooms for qualitative and quantitative analysis; engine rooms, with magneto-electric machines; battery rooms; complete telegraphic stations; rooms for preparations, balances, spectroscopic studies, and other scientific experiments and investigations; museums of mineralogy, geology, and collections of natural objects and curiosities of different kinds; and it is furnished with a very large and choice collection of philosophical and chemical apparatus ordered from the best constructors of Europe and America, and with all that is necessary for lecture demonstrations and experiments, for private study, and the most complete and delicate chemical analysis and manipulations.



ST. IGNATIUS CHURCH AND COLLEGE, SAN FRANCISCO, CALIFORNIA.

Retaining Walls.

These, until near the latter end of the last century, had been usually built with horizontal foundations and courses, the interior side being almost vertical, and the exterior with a flat face and very little batter, or in many cases vertical. The curved face retaining wall was latterly introduced, with the foundation and courses inclining from the horizontal, so as to conform with the radius of curvature. This form of wall is preferable, in many cases, to the old, as combining greater strength with a less section, and being more convenient in other respects, and was commonly used by Rennie in his various works, when applicable. To whom the introduction of this improved form of wall is due it is difficult to ascertain with accuracy; but Rennie, Ralph Walker, and Jessop were among the first who brought it into use. A further improvement was made in the retaining walls used at Sheerness, in 1815, by Rennie, where the foundation, being composed of soft alluvial mud and quicksand to a great depth, more than usual precautions were necessary to render the walls substantial and secure.

The object was effected by enlarging the base, and making the interior hollow, like a caisson, with the bottom in the form of an inverted dome; the outer or river face being concave, and the foundation, for a certain width, laid inclining at right angles to a tangent from the curved face of the front of the wall. The remainder of the foundation was horizontal, and the back or land side of the wall was vertical. Thus there was both a front and back wall connected together by cross walls, forming one mass; the inverted arches or domes under the hollow spaces being filled with chalk and gravel concrete, and the whole resting upon a well connected platform of piles and cross beams and planking. By thus distributing the same quantity of materials over a greater surface, the vertical weight per square foot was reduced, and the desired stability was obtained upon this very difficult and treacherous foundation. Rennie had previously tried with success a wall of a similar principle, and under similar circumstances, at Grimsby. General Bentham also tried a similar principle, about the same time, which was not so successful, in consequence of an unsuitable form and construction.—*Sir John Rennie.*

Venetian Pavements.

A foundation is laid of lime mixed with *pozzolana* and small pieces of broken stone; this is, in fact, a sort of concrete, which must be well beaten and leveled. When this is perfectly dry, a fine paste, as it is termed by the Italians, must be made of lime, *pozzolana*, and sand. A yellow sand is used, which tinges the mixture. This is carefully spread to a depth of 1 or 2 inches, according to circumstances. Over this is laid a layer of irregularly broken minute pieces of marble of different colors, and, if it is wished, these can be arranged in patterns. After the paste is completely covered with pieces of marble, men proceed to beat the floor with large and heavy tools made for the purpose. When the whole has been beaten into a compact mass, the paste appearing above the pieces of marble, it is left to harden. It is then rubbed smooth with fine-grained stones, and is finally brought to a high polish with emery powder, marble dust, and, lastly, boiled oil rubbed on with flannel.—*C. H. Wilson.*

Wrought Iron Columns.

Since a flat plate will bend sooner than a curved plate, it would be concluded, naturally, that a round tube, of moderate dimensions and of given thickness and section, would be a stronger form than the same plate in a rectangular form, in which the resistance to crippling must depend solely on the four angles; and since the rigidity afforded by the angles is extended throughout the four sides of a rectangular tube, in some manner proportionate to the distance from the angles, it would be concluded that a square tube would be stronger than a rectangular tube constructed with the same plate, inasmuch as the central portions of the longer sides of the rectangle will be less maintained in form, on account of their greater distance from the angles; similarly increased strength might be expected from this form. These assumptions were all submitted to experiment, and confirmed. For this purpose a number of tubes or cells of wrought iron were constructed, all 10 feet long, and either 4 or 8 inches square or of rectangular form, about 4 by 8 inches. Their ends were perfectly flat, and they were compressed, by the intervention of a lever, between two parallel disks of steel, with arrangements for maintaining the pressure perfectly vertical, the cells being supported laterally. The direct object was to ascertain the value of each particular form of cell, and to ascertain the resistance per square inch of section in each case.

The lateral dimensions of these cells are so large that with a length of 10 feet the pillars were not destroyed by a flexure, as in a long pillar, but by absolute buckling or crushing. The strongest possible form should therefore give about 16 tons per square inch of section. Similar experiments were then made with circular shells, under precisely similar circumstances, for comparison. The cylinders varying from 1½ inches to 6 inches in diameter, the diameter being so small in some cases, as compared with the length, some of these pillars failed by flexure, and followed the laws of long pillars, the resistance increasing nearly inversely as the square of the length; but where the diameter was 6 inches, the length being 10 feet, flexure could not take place, and the cells failed by buckling or crushing, as in all the rectangular pillars, and in such pillars the strength is independent of the length. From the foregoing researches, it will be observed that, in order to attain the maximum powers of resistance to compression in the use of iron plates in construction, the square box with thin plates, next to the plate itself, is the weakest experimented upon; the next in the order of strength is the rectangular form with a division across the center, as at *a*; but the best distribution of the material is in the cylindrical form.—*W. Fairbairn.*

Tests of Iron.

The breaking strain does not indicate the quality, as hitherto assumed. A high breaking strain may be due to the iron being of superior quality, dense, fine, and moderately soft, or simply to its being very hard and unyielding. A low breaking strain may be due to looseness and coarseness in the texture, or to extreme softness, although very close and fine in quality. The contraction of area at fracture, previously overlooked, forms an essential element in estimating the quality of specimens. The respective merits of various specimens can be correctly ascertained by comparing the breaking strain jointly with the contraction of area. Inferior qualities show a much greater variation in the breaking strain than superior. Greater differences exist between small and large bars in coarse than in fine varieties. The prevailing opinion of a rough bar being stronger than a turned one is erroneous. The breaking strain and contraction of area of iron plates are greater in the direction in which they are rolled than in a transverse direction. The breaking strain of steel, when taken alone, gives no clew to the real qualities of various kinds of that metal. The contraction of area at fracture of specimens of steels must be ascertained, as well as in those of iron. The breaking strain, jointly with the contraction of area, affords the means of comparing the peculiarities in various lots of specimens. The breaking strain and contraction of area of puddled steel plates, as in iron plates, are greater in the direction in which they are rolled, whereas in cast steel they are less. Iron, when fractured suddenly, presents invariably a crystalline appearance; when fractured slowly, its appearance is invariably fibrous. The appearance may be changed from fibrous to crystalline by merely altering the shape of specimen so as to render it more liable to snap. The appearance may be changed by applying the strain so suddenly as to render the specimen more liable to snap, from having less time to stretch. Iron is less liable to snap, the more it is worked and rolled. The "skin" or outer part of the iron is somewhat harder than the inner part, as shown by appearance of fracture in rough and turned bars. In the fibrous fractures the threads are drawn out, and are viewed externally, while in the crystalline fractures the threads are snapped across in clusters, and are viewed internally or sectionally. In the latter cases, the fracture of the specimen is always at right angles to the length; in the former, it is more or less irregular.—*D. Kirakldy.*

Sunflowers for Fuel.

It will probably curdle the blood of the æsthetic reader to learn that the superb and leonine sunflower is grown out West for fuel. They have been raised in Russia and Tartary for centuries for that purpose, but their introduction with us is of recent origin. Out in Dakota they are planted like corn. They are harvested in two parts, the seed heads being cut off and put away in a corn crib, and the stalks piled in a shed. When cut in the right time, the stalks when dry are hard as oak, and make a good hot fire, while the seed heads, with the seed in, make a better fire than the best hard coal. The seed, being very rich in oil, will burn better and longer, bushel for bushel, than hard coal. The sunflower is also extensively cultivated in certain sections for the seeds, which are used to feed fowl.

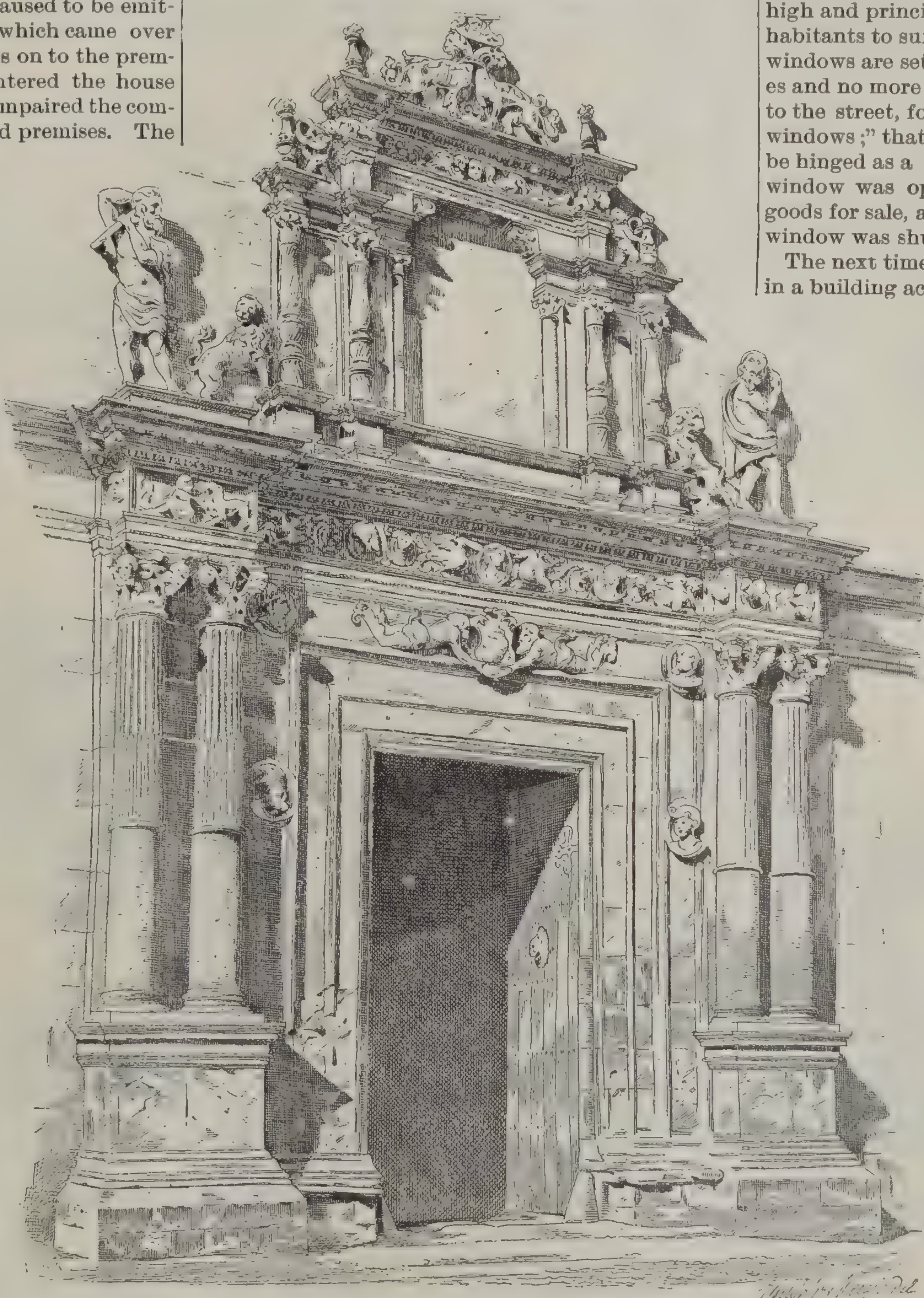
Law Applied to Smoke and Noise.

The case of Bier vs. Cooke, decided by the New York Supreme Court, and reported in the forty-fourth volume of the Supreme Court Reports, will furnish interesting reading to owners of steam mills. The opinion of the court is one of the latest additions to legal lore on the subject of what constitutes a nuisance at common law. The defendant, Cooke, owned and operated a sawing, planing, and turning establishment and sash and blind factory; but as the case was not decided with reference to the particular nature of the business carried on, the legal rules laid down will apply as well to the operation of a steam mill of any kind. This mill was situated in an inhabited portion of the city of Rochester. The plaintiff occupied, as tenant, a dwelling house in the adjoining lot. The action was originally commenced by the tenant and the owner combined, but for reasons discussed below the complaint was dismissed as to the owner, while the tenant was allowed to recover. The complaint set up that the operation of the mill produced much noise and vibration, shook the premises occupied by the dwelling house, and caused to be emitted smoke, vapor, cinders, and soot, which came over from the mill and defendant's premises on to the premises occupied by the plaintiff, and entered the house and interfered with and substantially impaired the comfortable enjoyment of the house and premises. The plaintiff was allowed to recover money damages, notwithstanding the fact that the mill had been carefully conducted, smoke consumers had been introduced, and all modern appliances and inventions brought into use, in order to discommode the neighborhood as little as possible. In addition to the judgment for damages, an injunction was allowed to issue restraining the owner from operating the mill and machinery and from allowing steam, smoke, soot, cinders, and partly burnt shavings from issuing from his manufactory so as to occasion a nuisance or annoyance.

This was a case in which it is always best to go into court with a cloud of witnesses, for upon the facts proved by the testimony will depend the result. The plaintiff, as a basis for money damages, succeeded in establishing to the satisfaction of the court that the house was sometimes enveloped in dense smoke, that soot and dust were deposited on the windows and in the rooms and upon clothes and laundry hung in the yard to dry, and that similar annoyances were caused by cinders and partly burned shavings. The allegation of discomfort and annoyance caused by the vibration from the operation of the machinery was not proved, and that element was therefore eliminated from the case in the appeal to the Supreme Court. For some time prior to the commencement of the suit, the mill property had been occupied as a public school, and on general principles one would say that of the two the public school next to the dwelling would have been the greater nuisance, but the evidence of the plaintiff showed that the occupants of the premises had not, previous to the construction of the mill, been subject to any annoyance which could be deemed a nuisance. Upon the facts proved the court proceeded to lay down the principles of law that while it is true that persons living in the city must suffer the consequences which come from the bustle and noise incident to the activity of business and the manner in which it may be done, yet they are entitled to protection against the carrying on of a trade or business in a manner which materially injures their property, affects their health, or renders the enjoyment of it physically uncomfortable. The owner or occupant of premises has no exclusive property in the air, but he is entitled to have it free and uncorrupted by foreign substances, gases, vapors, smoke, cinders, and matter which tends to materially injure his premises or substantially impair his health or physical comfort; and when this is brought about by the manner in which an adjoining owner uses his property, the use will be treated as a nuisance and a legal remedy afforded.

As already noted, the question of noise and vibration was not considered by the court on appeal, but previous adjudications hold that noise and the vibration caused by machinery, whether accompanied by smoke, noxious vapors, or cinders, may create a nuisance, and be the subject of an action at law for damages and in equity for an injunction. It is not every trifling noise or annoyance from smoke and soot arising from the conduct of a lawful business in an ordinary manner that will receive a remedy from an appeal to the courts, provided the business is conducted at reasonable hours and in a reasonable manner. The question is, Does it materially disturb the quiet and repose or substantially interfere with the comfortable enjoyment of the neighboring premises? If so, it will be held a nuisance, whether the trade is lawful or not, and despite the fact that extra precautions and all the modern inventions and appliances are taken and brought into use with a view to lessening or preventing discomfort and annoyance. The owner of the premises in the Rochester case was not allowed to prosecute, and the legal remedy was confined to the tenant alone. No man can complain individually or maintain a private action of or on account of such a nuisance as has been described, unless he can show that he has sustained some special damage peculiar to himself. So long as the tenant continued in the occupancy of the premises, and paid the rent, the owner was not legally injured. But were he able to show that, by reason of the noise and vibration or of the smoke, soot, and cinders, his premises became vacant and he could not get tenants, or was obliged to lease at less rental, then he would have a special damage of which to complain.

A word as to the measure of damages in such cases. It was shown that, if free from the disturbance complained of, the house was worth $700 per annum, but subject to such disturbance it was worth only $300 to $350. The Supreme Court decided that this was a proper way of getting at the damage sustained, inasmuch as the injury affected the use of the whole premises, and moreover that the plaintiff could recover for not only the damage sustained previous to the commencement of the action, but also up to the time of the trial, which may frequently be some time after the suit has been commenced.—*Myron T. Bly, Milling World.*



PORTAL OF THE RIQUELME HOUSE, JEREZ ON THE FRONTIER, SPAIN.

To wash lamp chimneys so they will not crack, place the chimneys in cold water, and then gradually heat until the boiling point is reached, then allow them to cool slowly. By repeating this operation several times, the glass will become thoroughly annealed, and no fear of cracking need be had.

Shop Fronts in London.

The history of the shop front is somewhat curious. The act for rebuilding the city of London after the great fire (18 and 19 Car. II.) is supposed to have been drawn by Sir Christopher Wren, but upon what the supposition is based does not appear, unless it be the internal evidence of sound, practical knowledge and general good sense which pervade the statue. This act, after requiring that "the outside of all buildings in and about the said city be henceforth made of brick or of stone, or of brick and stone together," with certain exceptions in that respect as to brestsummers "for conveniency of shops," directs that "no trapdoors or open grates be in anywise suffered to be made into any cellar or warehouse without the foundations of the front, but that all lights to be made into any of them be henceforth made upright, and not otherwise; and that no bulks, jetties, windows, posts, or anything of like sort, shall be made or erected in any streets, lanes, or by-lanes, to extend beyond the ancient foundations, nor that any house be set further into the street than the ancient foundations, saving only that in the high and principal streets it shall be lawful for the inhabitants to suffer their stall boards (when their shop windows are set open) to turn over and extend 11 inches and no more from the foundation of their houses into the street, for the better conveniency of their shop windows;" that is to say, the shop window board might be hinged as a flap and be turned out when the shop window was open, as a stall, upon which to expose goods for sale, and, of course, to be turned in when the window was shut.

The next time the stall board makes its appearance in a building act, the permitted turn-over flap had become a fixed projecting base to the bayed or bowed and fixed shop window, inclosing the space allowed by law to the hinged flap while the shop was open only; and the penthouse shelter for the public, which the act of Charles II. had required to be made over the paved footways before the houses, had become the cornice to the protruded shop front. Thus a "bulk" with "windows" in it came to be extended "beyond the ancient foundations," contrary to Sir Christopher's wholesome provision as to such things; and after time had honored the abuse by winking at it for two or three generations, the 12 Geo. III. c. 73 made a bow window or other projection "for the convenience of a shop or shops" an exception to its general prohibition of "bow windows or other projections against or before any house or other building situate in any public street, lane, or place," limiting the protrusion of the datum—the stall board—to 5 inches in lanes and narrow streets, and to 10 inches in any street being more than 32 feet wide.

The prohibition and exception as to projections and protruded shop fronts are continued in the 14 Geo. III. c. 78, now known in London as the Old Building Act, more in detail than in the earlier act, and with an alteration of 32 feet into 30 feet as the width of a street which would admit the greater protrusion of shop front. Hence it appears that an ill-judged concession to the shop-keeping citizens in the time of Charles II. has had the effect of making Cheapside, Ludgate Street, Fleet Street, and the Strand in the older parts, and indeed all the old shop streets and lanes throughout London, from one to two feet narrower than they would have been if the concession as to the turn-over stall board had not been made, as the shop front excrescence would, in all probability, otherwise never have been devised.—*Hosking.*

Fast Track Laying.

A remarkable feat of track laying was performed recently on the New York Elevated Railroad. Track laying on that road is carried on under difficulties, since trains run at 1½ to 5 minutes' interval at all hours of the day and most of the hours of the night, and at 15 minutes' interval throughout the few remaining hours.

Contrary to what might be expected, it has been found preferable to do all ordinary track work by daylight, despite the more frequent trains.

In 95 minutes on the morning of Aug. 18 a gang of 18 men changed the rails on 1,000 feet of track by taking out 66 old 50 pound rails and putting in as many 70 pound rails in their place, completely spiking them and inserting Bush interlocking bolts at the joints, all without delaying a train.

Lime.

Lime, whether in a state of purity or (as is more usual) mixed with other substances, is the material used from the remotest times to bind together stones and all the constituent parts of buildings. If lime be not found in any part of the globe pure, the rocks from which it may be extracted—the calcareous rocks—exist almost everywhere. No mineral is so widely distributed by nature. It is rare that calcareous stones are entirely pure, or exclusively composed of lime and carbonic acid. Their substance is usually made up of silex, aluminum, magnesia, oxide of iron, manganese, etc. Thence the terms adopted by mineralogists of argillaceous, magnesian, ferruginous, or manganesian limestones. These limestones furnish, by roasting, very different limes. Builders distinguish many kinds of them—rich lime, poor lime, hydraulic lime. Rich lime increases greatly in bulk when slaked; its weight is more than doubled. This property would be very valuable in respect of economy, did not rich limes remain a long time without hardening, especially in the center of masonry, and particularly where they are kept from the action of the air.

Rich limes, moreover, are dissolved to their last particles in water frequently renewed. This solubility of the lime in time converts masonry into mere heaps of stones—quay walls, for instance, which have been supposed to have been built of strong masonry and with the greatest solidity. Is it necessary to cite examples to show that the rich limes will not harden without the action of the air? We may point to the fact that M. Treussart, having had to reconstruct, in 1822, at Strassburg, the foundations of a bastion built in 1666, found the mortar there as fresh as if the masons had laid it some hours before. A similar circumstance was observed at Berlin by the architects who took down one of the pillars of the tower of St. Peter, built about eighty years ago.

Are we required to show that the constant action of water dissolves rich lime in masonry? We choose, among a thousand examples, the demolition of the remains of the ancient sluices of the Vilaine. During this operation, it was found that, by the dissolving of the rich lime, there remained behind the revetement walls nothing but masses without cohesion—simple heaps of loose stones. Poor or thin lime has all the defects of rich lime, and, moreover, as its name indicates, but slightly increases in bulk. The use of it is, therefore, as much as possible avoided.—*D. Arago.*

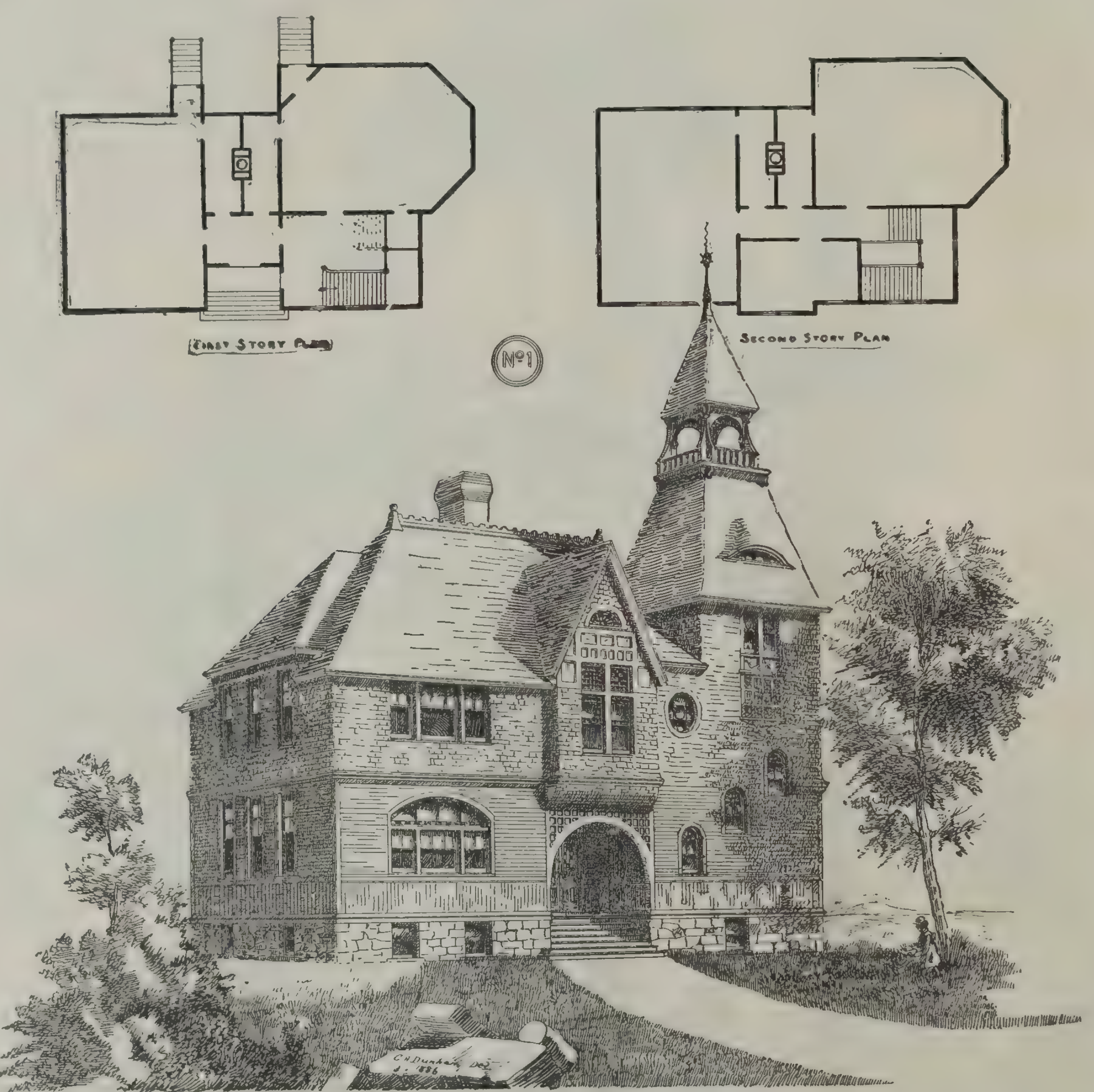
Rendering Brickwork Waterproof.

Perhaps one of the best linings is asphalt, and the Hygeian Rock composition has been used with success. A mortar that is said to be waterproof is made with lime slaked with green vitriol instead of water. The quantity of green vitriol is dissolved in warm water, the lime is then slaked in the usual manner and then mixed with fine quartz sand. For waterproofing brick walls, the following mixture has been recommended: Soft paraffin wax 2 pounds, shellac $\frac{1}{2}$ pound, powdered resin $\frac{1}{2}$ pound, benzoline spirit 2 quarts; dissolve these by gentle heat in a water bath, then add one gallon of benzoline spirits and apply warm. The mixture is very inflammable, and must be kept away from the fire. We may mention here another method of making brickwork impervious to water, known as Sylvester's process, which was used with success on the Croton reservoir, Central Park. It consists in the successive application to the walls of two washes—one composed of Castile soap and water, and the other of alum and water. The proportions are $\frac{3}{4}$ pound of soap to one gallon of water, and $\frac{1}{2}$ pound of alum to four gallons of water. The walls should be quite dry and clean, and the temperature of air not below 50° Fah. The soap wash is laid on first with a flat brush and at a boiling heat. After 24 hours the wash becomes dry and hard, and the alum wash is applied at a temperature of 60° to 70° Fah. This is allowed to remain 24 hours, when the operation is repeated until the wall has become impervious to water. The number of applications required will depend on the water pressure to which the wall is subjected.

In the Croton reservoir case, four coatings were found to render the reservoir free from leakage under 40 feet head. Resin has been used also as a protection against moisture. Five parts of turpentine, heated and stirred in ten parts of pulverized common glue and one part of finely sifted sawdust, are then applied to the wall, which should be cleansed and heated by means of a lamp, so that the composition may run into every crack and joint. Very often a cement lining is of no use to make a tank watertight, especially where the bricks and joints are of an inferior description, and the aim should be to get a composition which, when heated, enters the pores of the brickwork and renders them impervious.—*Building News.*

DESIGN FOR A SCHOOL-HOUSE.

In our last number we presented several designs of school-houses by Mr. C. A. Dunham, architect, Burlington, Iowa. We now give another design by the same author. It shows a neat, substantial, and well-arranged structure.



DESIGN FOR A SCHOOL-HOUSE.—C. A. DUNHAM, ARCHITECT, BURLINGTON, IOWA.

Essence of Law.

In the experience of almost every business man some question of doubt frequently arises, which is answered in the following well-established condensed legal acts:

It is a fraud to conceal a fraud.

Ignorance of the law excuses no one.

Notes bear interest only when so stated.

The law compels no one to do impossibilities.

Signatures made with a pencil are good in law.

A receipt for money is not always conclusive.

Principals are responsible for the acts of their agents.

No consideration is sufficient in law if it be illegal in its nature.

The payee should be distinctly named in the note unless it is payable to bearer.

A bill may be written upon any paper or substitute for it with either ink or pencil.

A note obtained by fraud or from a person in a state of intoxication cannot be collected.

An indorsee has the right of action against all whose names were on the bill when he received it.

Notice of protest may be sent either to the place of business or of residence of the party notified.

The time of payment of a note must not depend upon a contingency. The promise must be absolute.

A note made by a minor is void; a contract made with a minor is void; a contract made with a lunatic is void.

If the drawer of a check or draft has changed his residence, the holder must use all reasonable diligence to find him.

An agreement without consideration is void; a note made on Sunday is void; contracts made on Sunday cannot be enforced.

Each individual in a partnership is responsible for the whole amount of debts of the firm, except in cases of special partnership.

If the letter containing the protest of non-payment be put in the post office, any miscarriage does not affect the party giving notice.

A note indorsed in blank—the name of the indorser only written—is transferable by delivery, the same as if made payable to bearer.

Lawyer Browning, in an address before the Connecticut Board of Agriculture, gives the law of that State, as he understands it, somewhat as follows: "My neighbor's children may have no right to go into my pasture berrying, yet if, while there, they are set upon and gored by my bull, which I knew to be dangerous, it is no excuse for me to say that the children were trespassing. My bull should have been confined. A man who knowingly drives a runaway horse may as well settle the bill at once for the injury done if he runs away. A horse that is accustomed to bite must not be hitched near a sidewalk where he can nip passersby. By the Connecticut statute, a dog is put on the basis of a vicious animal, and if he do injury it will be no defense for the owner that he did not know of his vicious disposition. If my dog takes away the pant leg of a peddler, or sets upon hunters or fishermen, and bites them, or injures cattle that are being driven along the highway, I am liable. Dogs may be confined when it is feared they will do mischief, and killed when found in the act. If one uses a watch dog to protect his property, family, or person, he must keep him under proper restraint." If one keeps a large dog for the protection of his yard, and chains him during the day, letting him loose only at night, he will not be responsible for injury to one who enters the yard at night after it is shut. This case was decided in England, but it may serve as a warning to young men who are accustomed to make evening calls that they should not tarry until such a late hour that the old gentleman would be justified in closing the gates and letting the dog loose.

Slate Bricks, Tiles, and Pipes.

Henry Dickson, of Pittsburg, Pa., says: I take the ordinary waste of the slate quarry, pulverize it by ordinary means, then mix with it aluminous clay in the proportion of about four parts slate to one part of clay, or five parts slate to one part of clay, according to the richness or adhesive quality of the clay. I then temper the compound in the ordinary manner, well known to the art, mould it into form, and dry the articles, after which they are burned in an oven or kiln, as usual.

By the use of slate of different colors—such as black, blue, red, and gray—for the manufacture of tiling, a very fine appearance may be given to a floor, while it possesses a finer grain and presents a smoother surface than that made from clay alone, and at a greatly reduced cost, while its durability is greatly increased; and the same effect may be produced by using brick of different colors for ornamenting the fronts of buildings.

The Vosburg Tunnel on the Lehigh Valley Railroad, four miles above Tunkhannock, Penn., was opened on June 26. The tunnel cost about one million dollars, and occupied three years in its construction, during which time five lives were lost in it by a fall of rock. The tunnel cuts off some very troublesome curves. The exact distance saved is four miles and 905 feet.

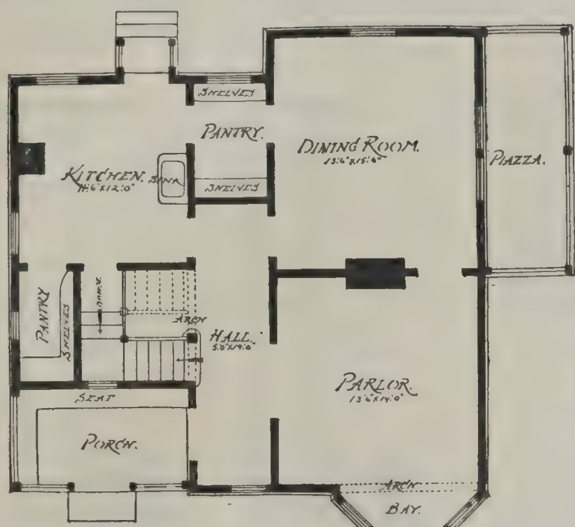
A Well Question.

W. D. C. says: I would like to inquire through the Scientific American what can be done with a well without relaying the present wall—a well that was curbed at the bottom with planks three feet square, and to a height of four feet, and a wall of stone of ten feet. There is quicksand at the bottom, and the planking will in time rot out. Would it be advisable to stone up inside the plank, and cement the same in any way, to hold back the sand, and at the same time hold up the present wall? If so, please state the kind of cement and materials that will make it strong.

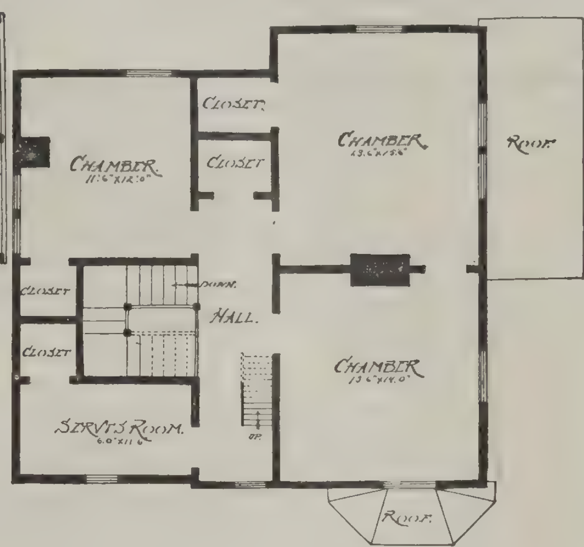
A.—Better leave it as it is until it is found that the same will cave in, or the planking rot out. If the latter is under water, it will last a great many years. As the present stone wall rests on the sand and planks, any wall now built inside of the planks would not support the wall.

A $3,500 COTTAGE.

This design is by Mr. A. W. Fuller, architect, Albany, N. Y. The estimated cost is $3,500, but this cost may be reduced or increased, in accordance with the means of the builder.



Principal Floor.



Second Floor.

A THIRTY-FIVE HUNDRED DOLLAR COTTAGE.

Building Organization in France.

The greatest difference between the building organization of England and that of France is in respect of the sub-contractor. In England he is sometimes the employe of the builder; sometimes he is thrust on the job—as happens with specialists—to the annoyance of the general contractor, who always believes he could find a better substitute. One of the builders' societies would hardly care to recognize him, and, however able he might be in construction or in art, the Institute of Architects keeps him at as remote a distance as if he were a hodman and wore dusty clothes. No matter what kind of trade or calling he may follow, he is sure to be isolated.

The French sub-contractor, on the contrary, is not afraid that the general contractor can hamper him, for he and men like him divide the work between them. The general contractor may be said to be unknown in France, and the architect has to deal not with one man or with one firm, but with several, even when his building is not of much importance. Here in England, any one who wants to have a house or a factory or a palace erected can easily find a builder who will supply him with plans and carry them into execution. That Frenchman must have an exceptional power of government who dispenses with an architect, and trusts himself to the representatives of the various trades.

A body of English sub-contractors would be created with difficulty. Where is the society which represents glass painters, tile makers, ventilating engineers, carvers, concrete workers, or one of the makers of the numerous specialties which are specified by the architects? In France, and more especially in Paris, there are almost as many *chambres syndicales*, or associations of employers, as there are trades to be undertaken. Let us glance at a few of them. There is the chamber for contractors of masonry, which has a mutual assurance against the risks of accidents in works that are executed in the departments of Seine and Seine-et-Oise. The office is open daily from ten to five, and the council hold their meetings once a month. Many of the masons are men of position, and belong to the Legion of Honor. The contractors for carpentry have also their assurance society in connection with their chamber. The council meets once in two months. The contractors for joinery and parquetry do not need an assurance society. The council have monthly meetings, and there is a committee who are always ready to examine all communications relating to the price lists which are issued. For it must be remembered that in Paris there are official prices, which are issued from time to time, for every kind of work. It is to the interest of contractors that a constant watch should be exercised over the fluctuations. The roof-coverers and plumbers form one chamber. In addition to the assurance society against accidents, they have another, which makes provision against losses by fire caused by the men, and for which contractors might be held responsible. The marble workers have two groups in their chamber, one relating to buildings and the other to monuments. There are also societies for heating, gas lighting, electric bells, etc.; painters, paviors, glaziers, locksmiths, tapestry workers, and so on. Trellis is largely used in Paris to conceal dead walls, and the *treillageurs* have their chamber and bureau. The house breakers or contractors for demolitions, the carters who convey building materials, have each a representative body, as well as the sculptors, glass painters, and paper stainers.

In addition there is a general administrative council that is constituted of officers from the different societies. By means of it much is done toward keeping the trades within their legitimate provinces, and toward insuring the recognition of rights. When so many independent contractors are occupied with a building, there is a risk that one set of men may impede the work of another set. It is, therefore, an advantage to have a central authority that is always ready to define rights.

It is not to be assumed that every contractor is a member of the *chambre syndicale* of his trade. There is nothing compulsory about joining, and the majority do not belong to the societies. But every chamber has sufficient members to exercise influence, and in most cases with benefit to the entire trade.

Another and no less effective aid toward conciliation exists in the Conseils de Prud'hommes, of which the origin is so remote that it cannot be traced. In cases where the damages do not exceed 200 frs., their judgment is final; in cases where a larger amount is sought, there is an appeal to the Tribunal de Commerce. In a list before us we find that building is represented among the Paris Prud'hommes by two master joiners, two master carpenters, one master mason, a quarry owner, a manufacturer of plaster, two locksmiths or iron workers, two makers of paints, two makers of room papers, and a brick maker, besides workmen belonging to several of the trades. In building cases, a tribunal of this kind has more knowledge than a tribunal of lawyers can have, and is sure to give more attention to the details. Moreover, the cost is infinitesimal, if compared with what would have to be paid if the litigation occurred in England.—*The Architect.*

A Novel Foundation.

A curious question aroused by the study of the Bologna towers, both of which lean somewhat from the vertical, is whether the movement has proceeded from the yielding of the foundation or of the soil. It is probable that the yielding of the soil is responsible for it, and it would appear also that the footings must have reached, on the lower side, a hard stratum which prevented them from further sinking, and has kept them in their present position for five hundred years. At the present time, the use of concrete, the great modern material, has enabled us to overcome many of the dangers of unfavorable subsoil, but we do not know everything that is to be known about the subject, and the investigation of the construction of the Pisa and Bologna towers could not fail to be interesting and valuable. To show how many expedients occur to observant builders under such circumstances, Mr. White relates a story of one who had occasion to build a high factory chimney on a bad soil. The chimney had been built twice, and had fallen down each time, but the contractor in question, after thinking over the problem, agreed to make himself responsible for the security of the structure. The site was on the bank of a stream, and the excavation showed the ground to be of very unequal texture and resistance. It might have been possible to test each portion separately, and proportion the footings to the resistance beneath them, but this builder prepared to meet the difficulty by concentrating the weight of the chimney on as small a space as possible, so that, although it might sink, the inequality of pressure between the different portions of the base would be slight, and being concentrated, instead of spread out in the usual form, such irregularity of pressure as might exist would have less power of dislocating the foundation. With this idea, he procured a large block of granite, which was roughly shaped in the form of a pyramid, and set in the bottom of the excavation with the point down. On the upturned base the walls were started, battering outward, until they reached the size required, and the chimney was then built upon them in the usual way. The form of the structure seems to have resembled that of an uncut cigar, stuck in the ground with the mouth end downward, but the designer's object was attained, and, although the chimney sank eighteen inches by its own weight, the sinking was vertical, and the structure remained upright.—*Amer. Architect.*

Early Use of Concrete.

Concrete, a mixture of gravel, sand, lime, and other cements, in certain proportions, was well known to the ancients, and in conjunction with the invaluable cement pozzolana, was applied with the greatest success in the then numerous moles and other submarine works, and its use has been still continued in Italy to the present day. Wren is said to have used it for a portion of the foundation of St. Paul's, where it was defective. Semple also alludes to it in 1776. Its use appears to have been discontinued for a time. Rennie proposed it for the foundation of the penitentiary in 1811, Smirke and others followed in the same track, and now the employment of concrete for the foundations of buildings has become nearly universal wherever it is necessary.

COMFORTS IN SMALL HOUSES.

The small comforts and conveniences of fixtures and fittings in our house is a very important matter, and one to which not half enough attention is usually given. In many cases, attention cannot be given, because the designer of the house does not always know the requirements of housekeepers, or, in other words, does not know that the essential of a comfortable house is the convenient arrangement of apparently little details, not merely closets and such things, but items throughout the house, on every floor, and, perhaps, every room. There are a great many men, and especially young men, who have not the opportunity of getting to know what these requirements are, and, in starting on their professional careers, are decidedly at a loss herein.

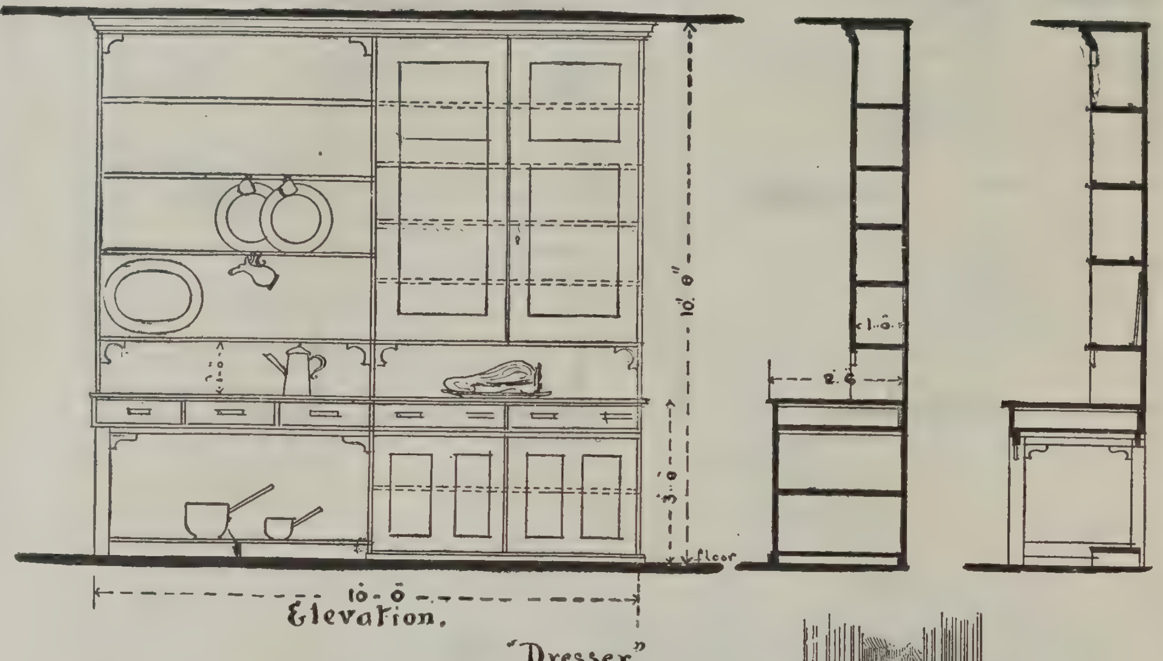
If a man builds his own house, he expects, when he lives in it, to find it perfection, and he will never get over the annoyance when, on entering it and settling down, he discovers the absence of some, perhaps, simple item, which, had it existed, would have made "all the difference in the world."

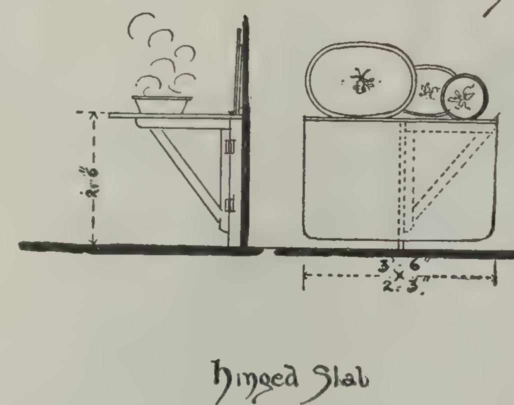
We are dealing with small houses of inexpensive type, with neat but plain exteriors. What money there was to spend on something more than the mere shell has been expended in comfort to the interior rather than ornamentation to the outside. To make our house as complete as possible, we will begin with the kitchen, that nursery of domestic comfort, for how very much depends on this department! If things go wrong in the kitchen, the whole house gets upset. First of all, then, we have the kitchen itself, not necessarily a large room, but still, the larger the better; about 15 ft. × 15 ft. is as useful a size as needs be. It is a great mistake to have it small. With a fair sized kitchen containing a good large sink, it *is* possible to do without a scullery, although the addition of a small one adds greatly to the comfort of the kitchen, as there is less crowding from pots and pans, and it enables the absolutely kitchen articles, used especially for cooking, to be kept apart from other vessels, such as laundry utensils, dirty pots, and waste stuff. It is, of course, impossible to isolate the servants' department in a small house, especially if the site is small; but still a great deal may be done to render the kitchen quite inoffensive by a little attention as to position of doors and windows, and to the offices connected with it. The kitchen must have a good sized window, capable of being opened to its full extent in mild weather, and having sliding panes (the more the better) for use in winter, so that the servant can at least have a quarter of the whole window open when desired, without having to throw open a half.

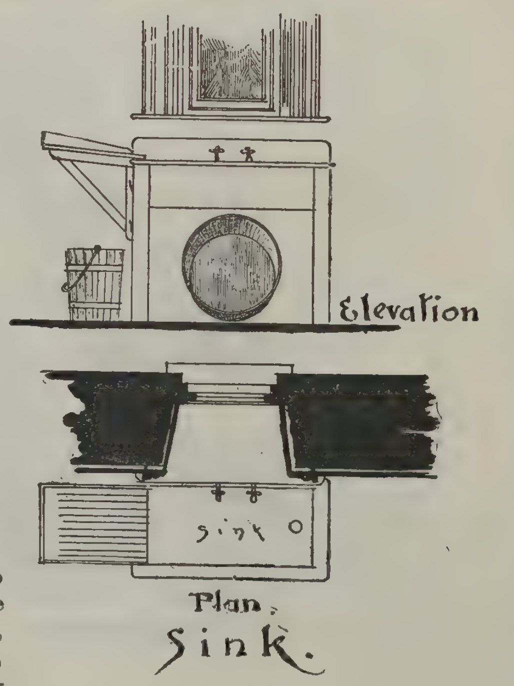
The principal convenience for a kitchen is a "dresser," and the best form is that shown in the accompanying sketch—open shelves for china in constant use, with nails or hooks on edges of shelves for cups and jugs; a cupboard for inclosing "cook's stores." This cupboard does not come down to the main board of the dresser, but leaves a clear space the whole length of the dresser, that the whole width of the table, etc., may be used. A few drawers below, varying in size, for kitchen clothes, etc., and such things, and a cupboard below half this row of drawers for the reception of cooking utensils. This cupboard should have a shelf. The other half of the lower division is an open place with a small shelf at the back low down, the object of this being to stand saucepans, etc., and the large cooking and laundry articles constantly used. All the shelves in the upper part should have a slip nailed along them to catch the edges of the plates and dishes as they stand leaning against the back. This piece of furniture, made in plain deal, quite unornamented, except for, perhaps, a small cornice to finish the top against the ceiling, is very inexpensive, and, put into the house by the carpenter as a part of his contract, will cost a mere trifle. The addition of a small shelf to draw out at will, to give extra table space, was a very common thing in dressers years ago. There is now and then a time when it comes in handy, but as a rule servants forget its existence, and find their table space sufficient without it.

In the old country houses in England, one often comes across dressers made of oak, really handsome pieces of furniture. These are relics of the past, and are sometimes two, or even three, hundred years old.

The kitchen table is invariably supplied by the tenant, and therefore cannot come into the category of "fixtures," but such a thing as a folding slab hinged to hang downward, and supported by a hinged bracket when in use, secured to a convenient wall, is a valuable addition to table space. Made as shown in the sketch, the part which is permanently horizontal is useful for standing trays on, on edge, which will not have to be moved when the slab or flap is raised or lowered. One mentions all these little things, such as trays, cup hooks, and so on, because a good housekeeper's invariable rule is, "A place for everything, and everything in its place;" and we have heard ladies recommend a servant as being such a good hand at keeping the kitchen tidy. And we know this, that a housewife is always wanting "a few more nails to hang things upon," so that it appears to be an essential to have plenty of places to "put things," as they say. If there is no scullery, a sink, of course, must be placed in the kitchen, and as near as possible to a window, both for light and air. It is always well to give the sink a separate window to itself; for if we would consider our servants' comfort at all, it is a pity to take up with the sink the only window at which they can sit when work is done. It is essential that the sink be well trapped before entering or connecting with any drain pipe; and it must be seen that the trap has a screw plug at its lowest part, that the pipe may be easily cleared of grease. A grease trap outside in addition is a capital institution, but in some climates the severe frost renders it useless in winter, and the thaws cause it to burst to pieces. The sink should never be closed in below; if it is, the inclosure forms a convenient receptacle for all kinds of rubbish and dirt, and if such places exist, servants will make use of them, and never clear them out. Instead of this, therefore, the sink should be supported on framing and plain legs, should have a drip-board on one side, usually the left, for convenience, which may be removed altogether when not required for use. Where there is a scullery, of course, the sink will be placed there, but always, wherever it is, it should be fitted up as described. We do not approve of covers for sinks to be closed when not used; the sink itself requires plenty of air. There can be nothing disagreeable, even to the most fastidious, in the appearance of a clean sink. In the scullery there should be shelves, perhaps inclosed, if this expense may be permitted, for boot brushes and blacking, knife cleaners, etc. Without doubt there should be a door leading from the scullery to the yard. If you can put up a light "lean-to" roof, supported by a couple of posts, or bracketed from the wall, so as to have a sheltered place under which to air pots, pails, etc., so much the better, and it will be found an advantage if the ground under this roof be laid with planks, properly fastened down. The windows should not open under this "shed," as possibly odors from the articles left there to air may be driven into the kitchen. Not far from the end of this covered way or shed should be the ash bin, and beyond this, again, a closet for the servants, either "earth" or "water," as circumstances dictate, but this arrangement depends upon the site and surroundings. Often at the back of a house in town is the only bit of garden a man can boast, and it would not do to spoil this absolutely, as one would if the servants' department occupied a very conspicuous part of it. With such conveniences as we have enumerated, a regular store closet for the cook's use can be dispensed with, but a necessity is a "pantry" of some kind, size, and shape. This would not be a "butler's pantry," fitted up with a sink and plate presses, china and glass closets, and so on, but would be used for keeping the eatables in, and out of the refrigerator, which may very well be kept here; and if this pantry is not too small, the housekeeper will always find uses for it. It combines "larder" and "open store room," and may be regarded as an essential in small house planning. Suppose our kitchen is on a floor beneath the dining room and must be reached by stairs, necessitating the carrying up and down of trays loaded with breakables. Take care to make these stairs as easy as possible, avoid winders as much as you can, make the narrow end of winders wide, if you must have them, and don't let the risers be too high. Introduce light direct; dark stairs are easy places for the crockery to be broken, and they are good conservers of dust and rubbish.







COMFORTS IN SMALL HOUSES.

The question of paving the kitchen floor is often alluded to, and deserves attention here. When all has been said, there can be no doubt that wood is best. Cement floors, though impervious to grease and easy to clean, are a mistake where the health of the servant is of account. To be standing and walking about all day on a floor so hard, unyielding, and unspringy, is very trying to the feet and legs. Wood floors can be easily kept clean with a little care, and by filling in below with concrete, these floors may be made rat and damp proof.

The store room, under the care of the housekeeper, is a very important place, and contains many a mystery of domestic economy. In houses where dining room and kitchen are on one floor, the store room would naturally be placed there also; but when the dining room is on a floor above the kitchen, the store room should be up there also. Over this the housekeeper exercises the most jealous watchfulness, and, indeed, it is her peculiar sanctum. In it, you will find she wants unlimited shelves, more and more hooks and nails, and good light and ventilation. China and glass and a hundred and one articles of "vertu," in a housekeeper's eyes, will be stored here. Besides groceries of all descriptions, to meet all wants, wine and beer have their places here in the absence of a wine cellar, and jars, empty as well as full, will be found herein. In addition to shelves, hooks, and nails, if you can arrange a small locking closet in a corner of the store room, you will make your lady client happy indeed. We have not alluded to the "laundry." A special laundry has to be done without in such houses as we are considering. Where there is a scullery, the washing is done there, but in its absence, it must be done in the kitchen itself. One more matter in connection with the kitchen department proper. It is a mistake, if you have a closet under the stairs, to let the back of it, which is formed by

the soffit of the stairs, go down to an angle with the floor. An upright partition should be placed as an end to the closet, not so far back that the servant cannot easily reach under the stairs to it when cleaning. Such a place is certainly to be avoided, as it is almost impossible to keep it clear of rubbish and dust. It is often a difficult matter to fit in a larder, if it is to have the necessary light and air. Put it in one place, and it will be too near the kitchen window; in another, too near the scullery, and so on; and often, as a consequence, a larder is dispensed with altogether and a refrigerator used instead. If place for a larder exists, by all means put one in, but let it have a couple of windows, so that a "through" draught may be obtained when desired. This also will insure a plentiful supply of light, for it is necessary that a larder be kept very clean, and there may be no dark corners into which rubbish can be thrown, or dust be allowed to accumulate. We have particularly mentioned a "dresser" to take the place of a cook's store room or closet, but where space and funds will admit, a small room, or even a mere closet, will be found of considerable use to the cook. Of course, if the small house has cellars, or even one cellar, that is cool and dry, any amount of things may be kept here, and part of it will often be found the very place to contain the refrigerator. A portion may be partitioned off to act as larder, the rest of the space being devoted to storage of packing cases and rough goods. It is a mistake on the score of economy to have gas in the kitchen, for it is quite impossible to teach a servant to use gas carefully. If, however, you have gas there, note carefully, before having the fittings put up, which will be the best position in relation to the cooking stove or range. A cook cannot be expected to turn out a dinner properly if she cannot see into her pots, or has the light behind her when superintending the mysteries of the roast.

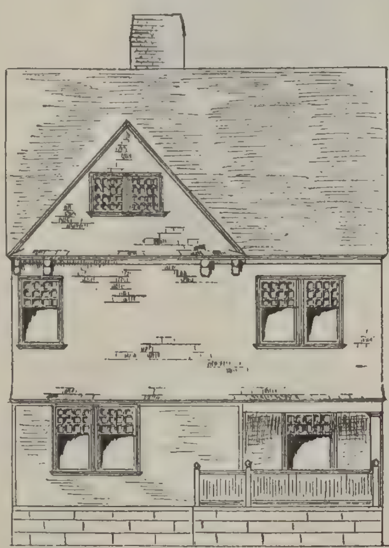
R. W. G. B.

(To be continued.)

A DESIGN FOR AN EIGHT ROOM COTTAGE.

This cottage is to cost about \$3,000. The first story, as far as the tops of the windows, to be clapboarded, the second story and roof of shingles, stained with Venetian red. The plans show the interior arrangement, with the exception of the laundry in the basement and a girls' room in the attic. The inside finish to be plain, but neat and stained.

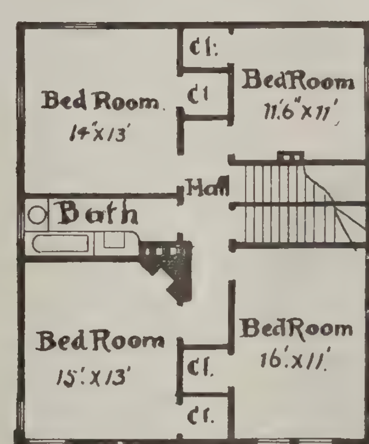
The height of ceilings is—in basement, 7 feet; first floor, 9 feet 6 inches; second floor, 9 feet; and attic, 13 feet to the ridgeboard.—Lyman A. Ford, architect, 2128 Euclid Avenue, Cleveland, Ohio.



Front Elevation

Side Elevation.

First Floor



Second Story.

DESIGN FOR AN EIGHT ROOM COTTAGE.

Recent Discoveries at Jerusalem.

A series of excavations have been made by the French Dominican monks at Jerusalem on some land which they have lately acquired, about a furlong and a half outside the gate of Damascus. About forty feet below the present level of the ground the workmen came on some arches of considerable extent, the walls of which had been very carefully built. At a short distance they found the basement of a chapel, before the entrance of which there was a tombstone covered with a long inscription. Unfortunately, this stone was stolen before any one thought of copying the inscription. About the middle of their property they found a large, well-preserved mosaic, and upon the space all around being cleared, the bases and other remains of great pillars were discovered. It is presumed that this is the site of the great basilica built in the fifth century in honor of St. Stephen by Eudoxia, the wife of Arcadius, the first of the Eastern emperors. While digging the trench for the foundations of the boundary wall which the Dominicans wished to build, the ground gave way, and one of the workmen disappeared. On clearing out the place, they came on a large hall which had been cut out of the rock; where the rock failed, the gap was filled by masonry. From two of the sides two large doorways led into two vaulted tombs, all of equal size. On each side of the vault there was a resting place for one coffin, and at the end opposite the entrance, places for two. At the furthest end of the great hall a passage led to another excavated vault, in which stood three great covered sarcophagi. It is suggested that these sarcophagi contain the remains of Helena, Queen of Abiadenos, and her sons. The quantity of bones found in these chambers was very great. In the middle of the great hall, in a hollow specially prepared, a sort of long metal box was found. It was adorned with representations of children holding garlands up on high. Unfortunately, there was no inscription, nor anything which could furnish a clew to the period or the purpose of these sepulchral chambers.

The Principles of Design.

A paper on "The Principles of Utility, Truth, and Beauty in the Art of Design" was lately read before the members of the Upper Bangor Literary Society by Mr. Grierson, architect, who remarked that there could be no doubt that the environment of our daily life exercised, for good or evil, an actual influence upon us. Recognizing this fact, the Government, strongly supported by the efforts of private individuals, had, of late years, been giving a good deal of attention to the cultivation of the popular taste in respect of what was termed by the late Owen Jones "the beautiful in form and color in the household." The sense of the beautiful was the common heritage of humanity. Differing in type, but not in species, wherever man was found, in the cold north or the sunny south, this "sensitive plant" in the garden of the soul had flowered, and seeded and sprung again. Art in all its forms was this flower, the language of this universal feeling. The feeling for beauty in its higher form presupposed an advanced stage of intellectual and emotional culture, yet the germ existed in all. As "the poet is born and not made," so must the artist, who was a poet in form or color, be born, not made. Yet, as had been wisely added by a late critic, "poets must be made as well as born;" and, however great the native genius might be, much study was also needed. The study of art could be pursued on very wide or very narrow lines, but in art the narrow way was not that which led to life. The three governing principles in the art of design were those of utility, truth, and beauty. All the chief errors in the art of design were due to the losing or exaggerating of any of these three elements. The perfection of utility, when achieved by skillful and honest work, came very near art; but a thing could not be called artistic if it lacked beauty in form or color. Neither could anything merely serviceable and beautiful be termed artistic in the strict sense of the word, if it did not also possess the merit of truth. There was a morality of art, no less imperative than the morality of conduct. A building or an article of daily use should no more pretend to be what it was not than should a man be a hypocrite. A chapel ought not to have a broad, lofty front, elaborately decorated, standing as a screen to hide a scantily proportioned and shabbily clothed posterior. A house built of inferior materials, and its walls covered with cement, upon which lines were drawn to represent the joints of stonework, or broad streaks of black paint in imitation of the half timber work of the old English style, was a sham and a falsehood. Nor should a house, a church, or a public building, a wardrobe or a chair, of to-day be put into masquerade by being made to imitate the buildings, the furniture, or the ceramics of the dead past. We must, if we were to have art at all, have a style of our own. Style is the vernacular of a people—the language of art at a given era. Our art should bear the impress of the activities, the reflections, and the hopes of the nineteenth century. We might go back to the past for inspiration and suggestion, but to reproduce past types would only give us crystallized images without life. The vitality of art consisted in originality. In architecture and the minor arts of design, much that was bad was due to a too slavish following of precedent and an unthinking acceptance of prescribed forms. The principle of truth in design also forbade us to follow nature slavishly. We might go to her as we went to history for suggestions, and should look to her for inspiration. It was an error arising from imperfect education in art to strive after as close an imitation of natural forms as the materials would permit. The art of design should aim at a conventional treatment of nature. Mr. Grierson then dealt with form and color in design, illustrating his remarks by citing examples from the history of art, and closed by referring to the subject of dress reform.

Repairing a Great Spire.

The tower of the ancient church of St. Stephen's, Vienna, which is supposed to have been founded in 1144, was greatly injured by an earthquake in 1519, and it was necessary to restore it. In course of time it deviated out of the perpendicular to a considerable extent. An iron bar was carried through it as an axis for the support of the spire, which, having a considerable tendency to vibrate, might be considered as an element of destruction rather than of strength. Consequently the thin wall of the lower portion of the spire was reduced almost to a ruin, and at length was in such a dangerous condition as to require rebuilding. The removal of the old spire was commenced in August, 1839, and in the following spring all the condemned parts had been removed. The mode of construction adopted in the restoration was novel and ingenious, the slight masonry of the spire being supported by means of a framing of vertical iron ribs, fastened at their lower extremities to a cast iron plate or base, and united to each other at intervals by horizontal rings of rolled iron. These rings are made to project from the inner surface, so as to admit of a person ascending, with the assistance of ladders, to the top of the spire. All the wrought and rolled iron employed in the construction of this iron skeleton, the weight of which was only 123 cwt., was manufactured in the government works at Neuberg, in Styria. The cast iron plates or rings were furnished from the government iron works at Mariezell. In the autumn of 1842, when the whole of the masonry of the spire had been completed, the upper portion, consisting entirely of ironwork, was fixed. This also was attached to a strong cast iron circular plate, similar in construction to that below. This portion of the framing, with the other ironwork employed in the spire, weighed about 80 cwt., so that the entire weight of iron was about 203 cwt. The new portion of the spire was connected to the old by means of an arrangement of iron anchor fastenings. The portion of the spire restored is about 182 feet high, the cost having been about 130,000 gulden (£13,000), of which sum 15,500 gulden were expended in taking down the old spire and in the construction of the necessary scaffolding.

Test for the Purity of Mineral Oils.

Mineral oils are used for the adulteration of animal and vegetable oils more frequently than the reverse; still, according to German experience, it is useful to know whether mineral oils to be employed for lighting purposes are sophisticated by the addition of fatty matters of extraneous origin. A handy test for this class of adulteration has been devised by Herr F. Lux, which depends upon the principle that alkalies when heated with fatty oils saponify, and form a gelatinous mass by the consequent solution of the soap in the excess of oil. It is generally found that when this kind of adulteration is resorted to, either to mask an inferior quality of mineral oil or for other reasons, at least 10 per cent of the adulterant is used. Any such large addition of fatty oil may be detected by adding a small piece of soda to 5 cubic centimeters of the suspected oil contained in a test-tube, and boiling the mixture for two or three minutes. If there is present any considerable quantity of fatty oils, this will be perceived by the empyreumatic odor which will be disengaged, and more surely indicated by the solidification which will show itself after a slight cooling of the tube. If no such result is apparent, the experiment may be carried further. Two glass beakers must be selected, of such a size that one will stand, with one or two centimeters to spare, in the other. A quantity of melted paraffin is to be poured into the larger vessel, and the smaller is then to be sunk in the fluid, which should rise to half its height. More paraffin is to be poured into the inner beaker, to the level of that outside; the object being to secure a paraffin bath in which the test-tubes of oil can be heated without risk of igniting. The temperature of the paraffin bath should be maintained at 200° to 210° C. Two test-tubes containing the suspected samples are used, in one of which is placed a few fragments of sodium, and in the other a cylinder of soda covered to the depth of one centimeter with the oil. The samples are thus heated for a quarter of an hour, then removed, wiped, and cooled. If 2 per cent of fatty oil is present, one or other of the tubes, generally both, will be full of a gelatinous, adhesive mass.

AN ITALIAN ARTIST'S RESIDENCE—SIXTEENTH CENTURY.

In the picture herewith of Tintoretto's house we have a suggestion of the many-sided development of Italian art during the last days of its most glorious period.

TINTORETTO'S HOUSE, VENICE, 1576.

Here, before his death in 1576, in his ninety-ninth year, Titian may easily be supposed to have often spent many agreeable hours with one of the only two Italian painters then worthy to be his companions, and one destined to sustain for almost a generation after him the glory of that school of which Titian had been the bright particular star. The house itself, as will be seen, is just on the water's edge, access thereto, as in the case of most of the finest buildings and residences of Venice, being from gondolas. The city itself seems from every direction to be floating on water, and presents a unique appearance of fairy-like picturesqueness, while some of its buildings and monuments, bringing before us as they do the history of more than a thousand years, offer much that is worth the study of all who are interested in tracing the development of artistic ideas in architecture.

Air Injectors for Liquid Fuels.

The Forges et Chantiers Company of France have again brought forward the principle of burning liquid fuel for furnaces by means of air injectors, originally introduced by M. Sainte-Claire Deville. The use of steam to spray the naphtha, creosote, or other liquid fuel is a serious inconvenience on board ship, owing to the great consumption of fresh water which it renders necessary. The importance of this point is obvious, when it is remembered that the burner spray requires from one-twelfth to one-tenth of the total production of steam of the boilers.

Modern steamships are all fitted with engines of the surface condensing type, using high pressure steam. The water evaporated for the steam jet must be replaced by salt water, causing wear and tear of the evaporating apparatus and a certain amount of additional danger. In the case of a steamship of 3,000 tons, for example, about 530 cubic feet of water is evaporated every hour. Supposing the best type of steam atomizer is used, requiring only one-twelfth of the steam evaporated, or say 44 cubic feet of water per hour, then 486 cubic feet of water will go in the shape of steam into the engines, returning in due course, diminished only by small leakages, into the boilers. The 44 cubic feet of water required by the steam jet will escape from the chimney as steam. In the course of a ten days' run, such a ship would consume from the atomizing jets not less than 10,560 cubic feet of water, all of which must be drawn from alongside or distilled for the special purpose. Distilling apparatus for such a purpose is out of the question; and the alternative is not likely to recommend itself to sea-going engineers. It should not be forgotten, moreover, that the steam mixed with it in the spraying apparatus greatly diminishes the efficiency of the naphtha.

It is with a view to the removal of these objections that the spraying of the liquid fuel by air instead of steam has been revived. There are two ways of applying this principle: by using compressed air in place of steam, or by so modifying the burner that all the necessary air for combustion shall pass through it, and be mixed as intimately as possible with the combustible. The first method is easily arranged, the only additional apparatus required being a small steam pump in the boiler room to compress the air into a reservoir for the service of the injectors. To avoid waste of water, the exhaust steam from this pump is led into the condensers. The second method is more delicate, but is preferable, as it permits of the realization of high evaporation duty. It can be secured by a fan driving into the furnace (not at an extreme velocity) all the calculated volume of air supply, partly as a cylindrical jet and partly as an annular jet enveloping the former, leaving the liquid fuel to flow between the two portions, and be thus atomized and projected into the furnace.

An Ocean Oil Well.

Captain Eden of the British schooner Storm King, bound from Utilla to New Orleans, reports on Thursday, March 11, passing over a submarine mineral oil spring, bubbling and rippling all around the vessel, and extending out over 150 to 200 yards. This was in latitude 25° 48' north, longitude 86° 20' west, about 250 miles southeast of the Passes. At 11 A. M. they were over the spring proper, and at 11:30 A. M. outside the circumference of the oil circle. It is supposed that this spring is the oil cargo of a foundered vessel, which, breaking through the casks, caused this peculiar marine freak, or that it may be a natural phenomenon.

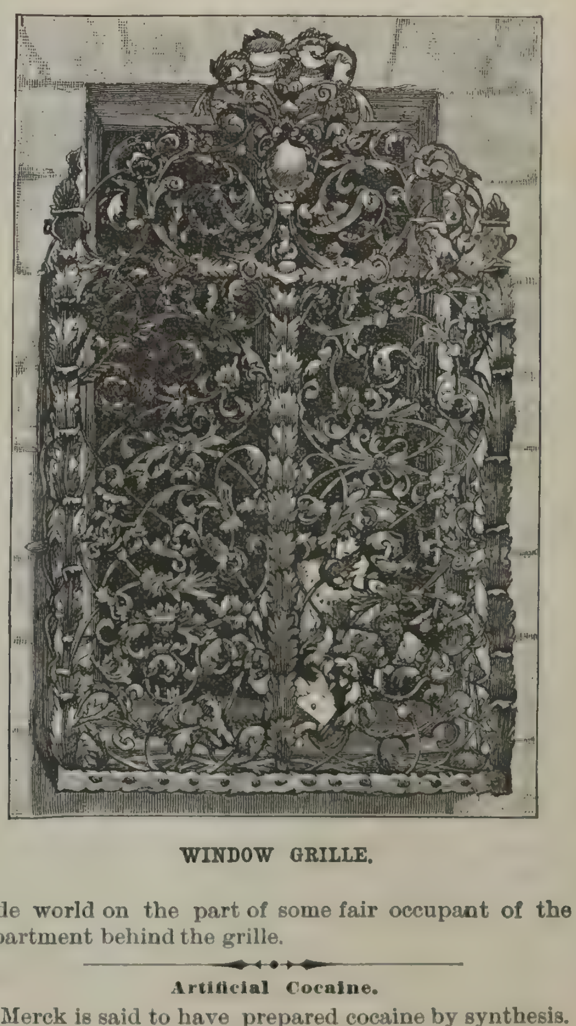
GROTTO OF MARIE DE MEDICI, THE LUXEMBOURG, PARIS.

ART IN THE GARDEN.

The magnificence of the historic palaces of France has been wonderfully diminished of late years, and their extensive parks and gardens, now no longer for the exclusive enjoyment of those of royal station or aristocratic birth, have been greatly curtailed. In the gardens of the Luxembourg there are now comparatively few relics of its former grandeur, but among these is the grotto of Marie de Medici, shown in our illustration, built some two hundred and fifty years ago. It is a broad basin, where the ladies of the court were wont to go and bathe, and though everywhere surrounded by trees, forms itself a sunny space that seems hewn out of the forest, the surrounding trees having formerly been kept trimmed and clipped above. The fountain and the highly ornamented miniature temple or arcade, the costly sculptures and the collections of rare flowers, make up a picture to delight the senses, and almost imperceptibly lead the imagination to conjure up the appearance of the brilliant throngs for whose enjoyment such lavish expenditure was made during the whole reign of Louis XIV.

A WINDOW GRILLE OF THE SEVENTEENTH CENTURY.

The accompanying engraving shows a very elaborate work of a German artist of the seventeenth century, in forged, chiseled, and hammered iron, having return ends, so that when fixed it projected in front of the window. It is now an exhibit at the National Industrial Art Museum at South Kensington, London. Its richness of effect as a decorative work, and great strength as a protection of a window, will be at once recognized. The design is divided into two panels, each balancing the other in the leading lines of the ornamentation, although there is also a suggestion of a cross in the whole. The division up the center and the side lines are made of acanthus leaves of hammered and chiseled iron laid over each other, the base of one leaf springing from behind the curved point of that below. The top is surmounted by a pediment having an oval escutcheon in the center, divided from the square of the grille by foliation starting horizontally from each side. The details are of a very ornate character, most of the work having been shaped while hot and chiseled afterward, while some grotesque terminal figures are introduced, which are entirely forged, and afterward finished with chisel and file. The artist's fancy has led to the introduction, also, of a suggestion of probably prohibited correspondence with the outside world on the part of some fair occupant of the apartment behind the grille.

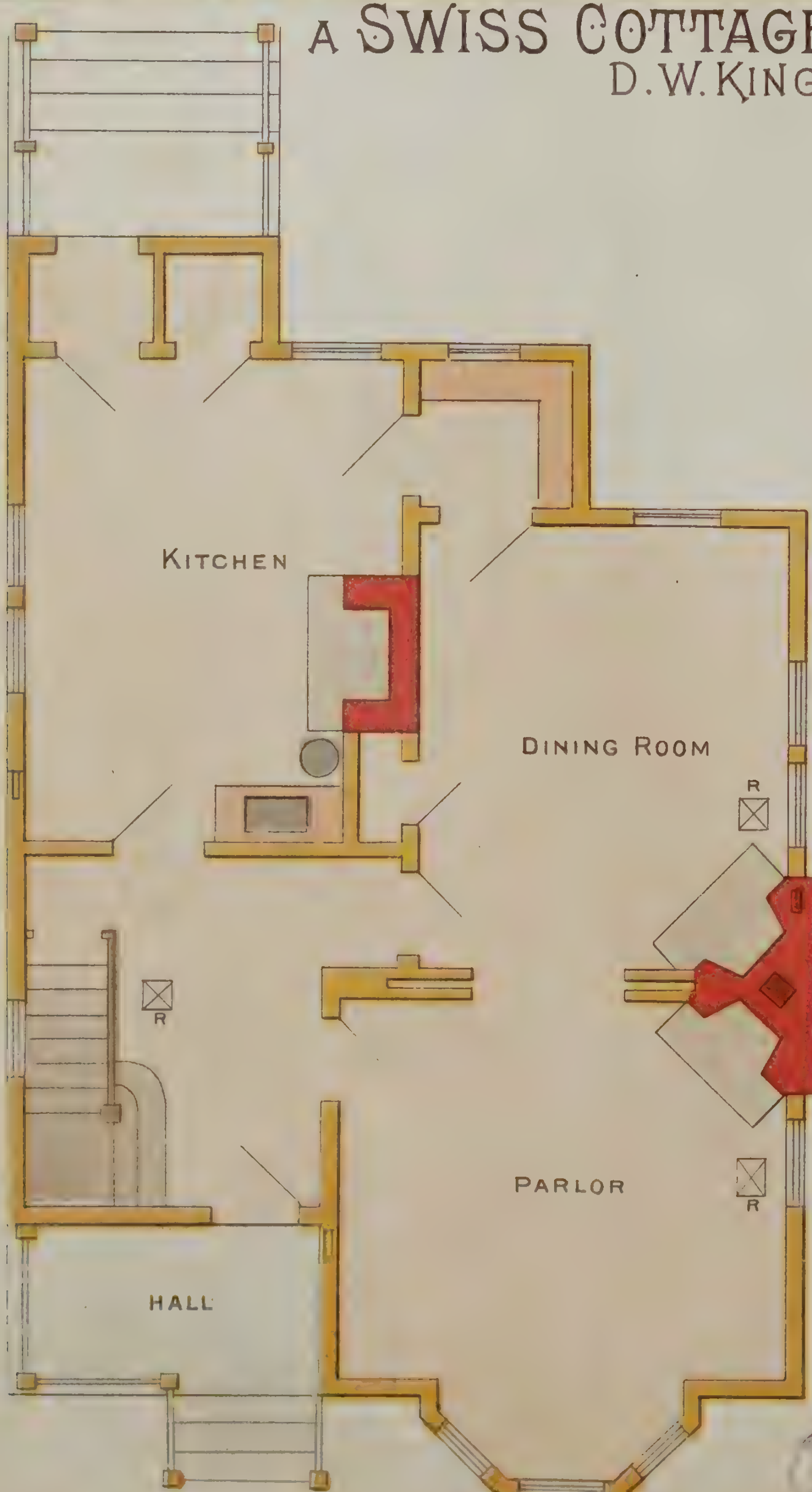


WINDOW GRILLE.

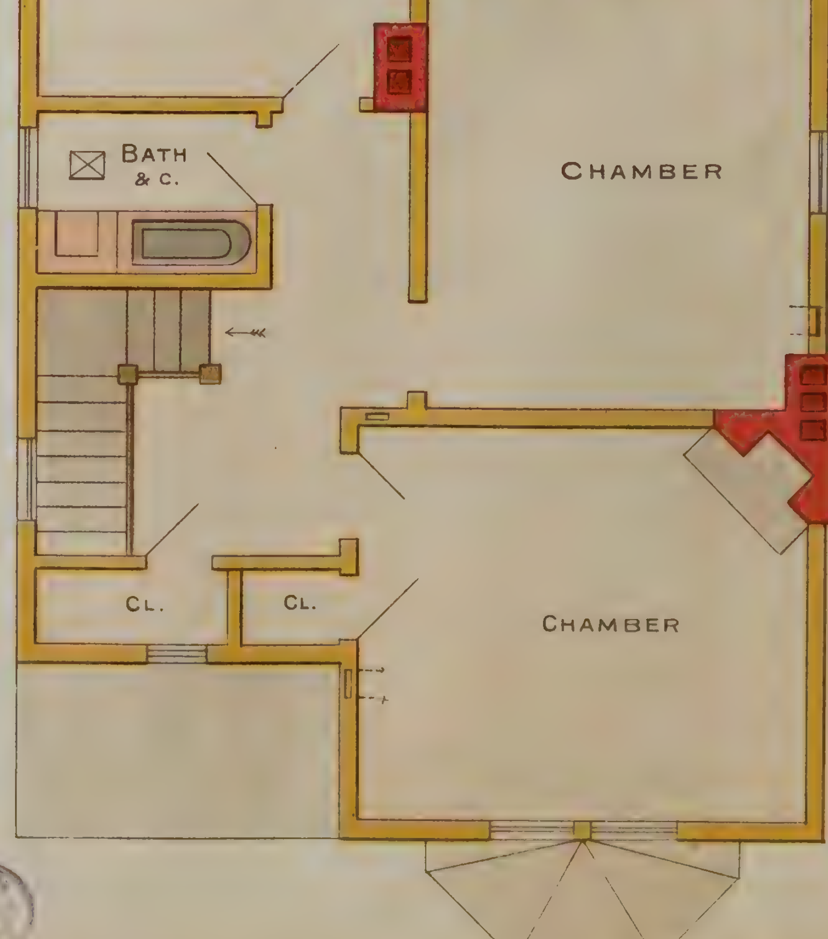
Artificial Cocaine.

Merck is said to have prepared cocaine by synthesis. Cocaine is benzoic methylecgonine. Benzoic ecgonine is treated with iodide of methyl in slight excess in the presence of methylic alcohol at 100° C.; the excess of iodide and methylic alcohol is driven off by heat; from the resulting sirupy liquid cocaine is extracted. This artificial cocaine melts at 98°, like its prototype, and it possesses all the reactions of the natural product.

A SWISS COTTAGE AT WEST NEW BRIGHTON, N.Y.
D. W. KING, ARCHITECT, N.Y.

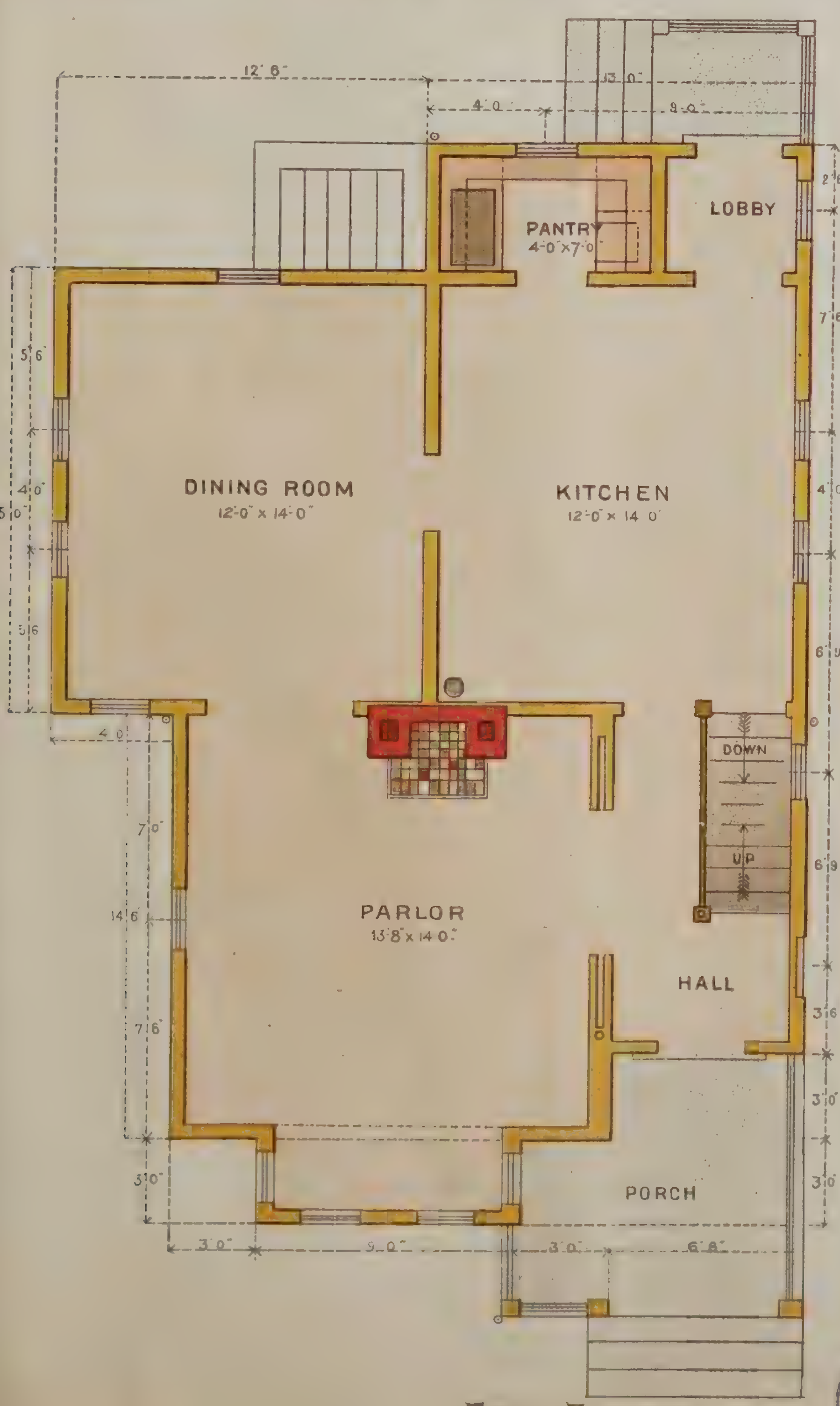


FIRST STORY.

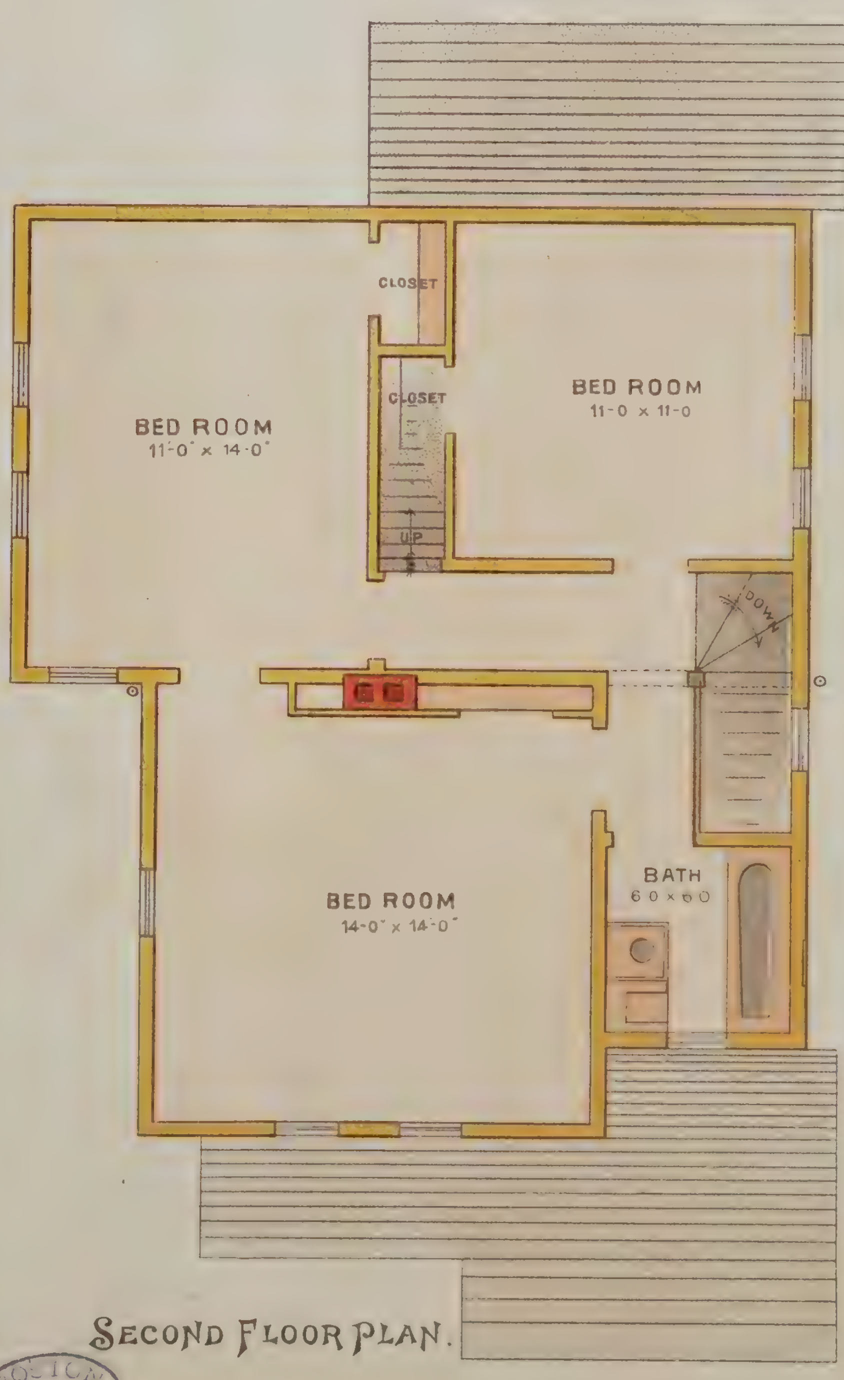


SECOND STORY.

·AN $1800 DWELLING· DESIGNED BY FRANK D. NICHOLS, BRIDGEPORT, CONN.



FIRST FLOOR PLAN.



SECOND FLOOR PLAN.

Precautions in Building.

Mr. D. Earnshaw, from an experience of 25 years in Manila, where the earthquakes were sometimes very severe, had come to the conclusion to build as strongly as possible, and chiefly in wood, tied and bolted together as in a ship, stone and brickwork only being used in the lower story and in the foundations, and especial attention ought to be paid to the quality of the lime and mortar used in construction. He did not agree with Mr. Milne as to the advisability of adopting loose foundations, as the impetus given to the structure by a heavy shock would certainly cause the whole to move a great deal more than if the pillars were fixed in solid foundations, and firmly tied together. Many materials had been used as roofing, such as the heavy tiles made in the country and others imported there. When, in 1880, fully 60 per cent of the buildings in Manila had been ruined, an order was issued by the municipal authorities to use corrugated iron or zinc sheeting for that purpose. A diversity of opinion existed as to which was the best and most suitable, for not only had earthquakes to be guarded against, but intense heat and disastrous typhoons. With reference to the latter, he had seen, in 1881, sheets of iron flying about in the air like paper. He thought, therefore, that a light, strong tile roofing was preferable to any other.

With regard to the continent of South America, Mr. G. Bush remarked that in the parts where he had resided the houses and all large buildings, such as warehouses, were erected of wood framing, and walled in and roofed with galvanized iron. One government block of buildings in Iquique, built of stone and cement, had withstood very severe shocks, especially one in 1877, when it resisted the great wave. Earthquakes did not interfere much with modern structures, but there was great danger from fires, which had been caused in several instances by the upsetting of kerosene lamps. Mr. H. S. Ridings, who had been resident engineer of the Iquique Railway, in giving the result of his experience, seemed inclined to agree with Mr. Milne on the importance of free foundations, but suggested, instead of shot, the much cheaper, simpler, and more effective plan of having a layer of clean, coarse sand, 1 in. thick, below the foundations of concrete, brick, and stone structures. Iron buildings and timber frame buildings, if carefully designed, and with an extra amount of diagonal bracing, seemed well suited for earthquake countries; but in the tropics they needed special provisions for ventilation. One of the largest buildings in Iquique had a heavy framework of timber, well braced, the interspaces being filled in with brickwork; this had resisted heavy shocks of earthquake. The city of Arequipa, Peru, was particularly liable to earthquakes, owing to its great proximity to the great volcano, the Misti, 19,000 ft. in height above sea level, the city being 7,000 ft. above sea level. The general construction of the houses was peculiar. A light-colored volcanic stone was largely used; this, when quarried, was easily shaped, and it hardened gradually. The roofs were for the most part strong arches, a very good mortar being used. In the earthquake of 1868, it was not so much those arches which failed as the walls, and the spandrels between the arches in front and rear. In some parts of the city, arches extending in one direction stood, while those at right angles to these were thrown down. Since 1868, a good many corrugated iron roofs had been introduced; but they were not suitable to the climate, and were not durable.

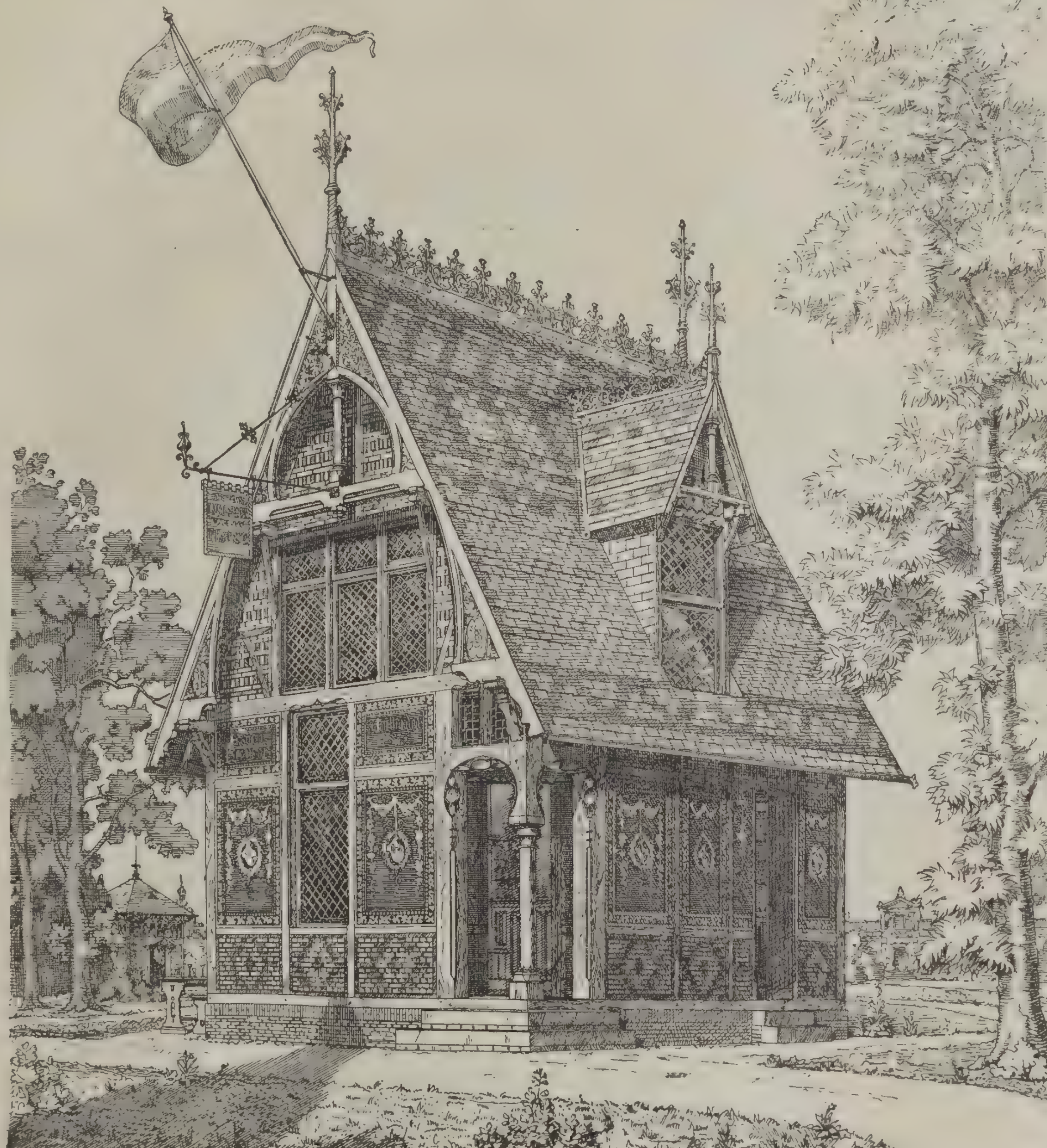
GELATIN, starch, and Irish moss soaked in warm water are among the substances generally used in making ice cream bricks. Ice mixed with the former requires a greater degree of heat to cause it to melt, and hence bricks of ice cream thus made stay hard longer on exposure than will ordinary ice cream.

The Pecan Tree.

The pecan tree is found in a wild state in the woods of the various sections of the South and West. It grows to a very large size, and bears yearly many bushels of fine flavored nuts. Though little or no attention has been paid to these valuable trees, cultivation greatly improves them, the nut growing much larger and improving in flavor. The pecan tree lives to a great age, and continues long in bearing. There is no good reason why it should not be grown extensively in all parts of the United States. It is well adapted to almost any kind of soil, doing well even on rocky hills and waste land. There is no nut or fruit tree more valuable and requiring so little attention. Every farmer, in my opinion, should have his nut orchard, and cultivate especially the pecan for home use or sale. The nuts always find ready sale at fancy prices. In planting the trees, the only object is to obtain good fresh nuts, and of a good early variety, of large size, from which to grow the trees. If it is preferred to set out the plants, get healthy trees of a good variety, one to two years old.

DESIGN FOR A REFRESHMENT HOUSE.

We give an illustration of one of the designs of Architect Jos. Th. J. Cuypers, which was shown at the Universal Exposition at D'Anvers, Belgium, 1885. Our engraving is from *L'Emulation.*



DESIGN FOR A REFRESHMENT HOUSE.—J. T. J CUYPERS, ARCHITECT.

Earthquake Buildings.

Professor C. Clericetti, of Milan, and Mr. W. H. Thelwall referred to the earthquake that occurred in the island of Ischia in 1883, which was of a most destructive character, and caused an enormous amount of damage in the island, two thousand persons having lost their lives, and many more being injured. A commission was then appointed by the Italian Government to obtain information about the earthquake, and to frame rules for the rebuilding of the structures. It was ascertained that, speaking generally, buildings founded on hard, solid lava had withstood the shock successfully, while those founded upon looser or lighter materials, such as tufa or clay, had suffered very much; and therefore, in regard to the re-erection of buildings, it was pointed out that the first thing to do was to select eligible sites, and to build, wherever possible, upon lava, and where that was not possible, to dig down to comparatively solid ground, and then fill in a heavy platform of masonry or concrete, 3 ft. or 4 ft. thick, extending over the whole area of the building, and projecting 3 ft. or 4 ft. beyond. The building of any kind of vaulting above ground was forbidden. Light arches were only to be allowed over windows and openings of that kind. The heavy flat roofs formerly used to a large extent were condemned. The commission recommended that buildings should be chiefly constructed with an iron or wooden framework, carefully put together, joined by diagonal ties, horizontally and vertically, with spaces between the framework filled in with masonry of a light character. The joists and the roof trusses were to be firmly connected together. In plan, buildings should be square, and where the direction of the last shock could be traced, one diagonal should be placed in this direction. Not more than two stories above ground were to be allowed, and there might be one under ground, but it must be of very moderate height. In no case was the height from the lowest point of the ground to the top of the walls to exceed 31 ft. Openings for doors and windows were to be vertically over each other, the jambs being not less than 5 ft. from the corner of the building. No openings for flues were allowed in the thickness of the walls, and no projections from the face of a building, except light balconies of wood or iron. In solidly built structures, and particularly if there was only one story above ground, the roofs might be covered with tiles; but these must be light, and fastened with nails or hooks, so as not to be displaced even by violent shocks. In other cases, zinc or corrugated iron was to be used, proper means being taken to keep out the heat. In certain buildings flat roofs would be allowed, but their construction must be of the lightest possible character.

The Friendship of Birds.

June 11, 1884, I saw what I took to be a robin's nest in a maple tree on a public avenue. Upon ascending was surprised to see a robin and an English sparrow fly from the nest, which was like an ordinary robin's nest, except being thickly lined with feathers, which were well embedded in the cement of the outer nest. It contained three eggs of the robin and six of the sparrow, all evenly and highly incubated. The eggs were not intermingled, each kind being on a side in a slight depression, but not separated from one another. The feathers which lined the nest, except the small ones at the bottom, were stuck quill ends in the cement, and the tops or feather ends curved inward, so as to nearly conceal the eggs. The robin and sparrow had been setting side by side on their respective eggs. It may be mentioned that these birds are usually enemies.—*The Oologist.*

PORTABLE IRON BUILDINGS.

BY AUGUST W. SCHULENBURG, ST. LOUIS, MO.

The main constructional parts are gas-pipe and corrugated iron.

A represents the standards or posts of gas-pipe, with threaded ends to be screwed into base-blocks, D, bolted to wooden stringers for foundation, and to girders supporting roof above.

In order to make the building rigid and firm, and tie and bind together the exterior line of standards or posts, A, and also to provide means for fastening corrugated iron sheets, C, to inclose the house, a gas-pipe, B, is laid horizontally against said standards or posts, A, and placed vertically, held in position by hook-eyes or brackets, a', screwed into standards, A.

Fig. 1.

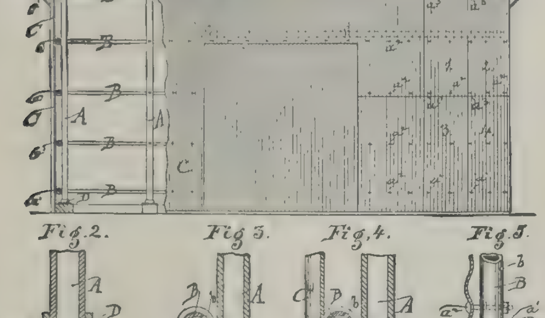


Fig. 2. Fig. 3. Fig. 4. Fig. 5.

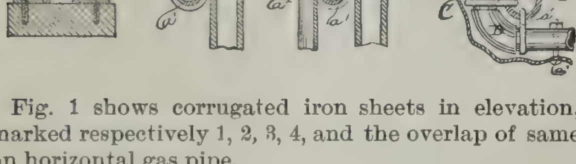


Fig. 1 shows corrugated iron sheets in elevation, marked respectively 1, 2, 3, 4, and the overlap of same on horizontal gas pipe.

A NOVEL CHIMNEY STAGING.

In a paper read at a recent Chicago meeting of the American Society of Mechanical Engineers, Mr. Frederick G. Coggin, of Lake Linden, Mich., supplied the following interesting account of a novel chimney staging:

In the fall of 1885, the Calumet and Hecla Mining Company completed a new brick boiler house for their stamping and concentrating works at Lake Linden, Mich. It was 206 feet long and 70 feet wide, giving room for 14 fire-box boilers, whose shells are 90 inches in diameter, with a total length of 34 feet. The chimney designed for this boiler house was to be of wrought iron, 13 feet 7 inches in diameter and 165 feet high above the brick base upon which it stood, and the top of the latter was 20 feet above the ground, making a total height of 185 feet above the surface. The courses were 5 feet high, with four sheets in each course, the ends and edges butted together, the joints being cov-

ered with straps riveted to the sheets on the outside. The first ten courses were $\frac{3}{8}$ in. thick, the second $\frac{5}{16}$ in., the third $\frac{1}{4}$ in., the top three courses $\frac{3}{16}$ in. thick. The late arrival of the material for the chimney, with other circumstances, brought the commencement of its erection rather late in the season, so that it became a serious question as to whether it could be completed in time to allow the brick lining to be put in before the freezing weather set in. In fact, it became evident that with the ordinary method of staging it could not be done. Such a staging would have required ten uprights of 8×8 in. timber, with the bracing necessary to hold them in position, and girting, and provision for a platform every 5 ft.—*i. e.*, for every course—sufficiently strong and wide to allow the workmen to stand outside for holding rivets and bolting together, all requiring not less than 26,000 ft. of lumber.

Such a staging would have to be put up in sections, during the operations for which the iron work would have to be suspended, and the time put upon the staging and platforms would be nearly as much as that for putting the plates in position and riveting, and the expense full as much. But, regardless of the question of extra cost, the delay which such a staging would occasion made it imperative to devise some more rapid method for raising the chimney, and the result was the plan illustrated in the cut. This consisted of a frame about 9 ft. square, with four 8×8 in. uprights, 16 ft. long, suitably braced and bolted together, with a platform at the bottom, one about 4 ft. from the bottom, which carried the workmen while riveting, and one still higher for carrying the forge, etc., the platforms being indicated by the letter P. Upon the top of this frame were four arms, B, jointed at the center, through which it was bolted to a cross girt, but so as to allow it to swing freely. To the ends of these arms were suspended the cages, D, by blocks and falls, as shown. These cages extended a little more than one-quarter round the chimney, and consisted of a segmental platform about 3 ft. wide, with a railing of gas pipe and covered with canvas to protect the workmen from the wind and prevent the possibility of their falling. The whole thing required less than 1,000 ft. of lumber.

The frame having been bolted together within the chimney base, the process of erection might be begun. The cast iron ring upon which the chimney was to rest having been put in place upon the top of the base, a loose platform was laid over the opening, and the first two courses were raised into place with a "gin-pole" and bolted together. Two snatch blocks were then hooked on to the upper sheet near the two opposite corner posts of the frame, at the bottom end of which were eye bolts, into which were hooked the hoisting ropes, which passed up through the blocks and down to the bottom through another pair of blocks on to the drum of a small steam hoisting machine.

The temporary platform was then removed, and the frame was raised high enough so that the two sticks of timber, A, could be placed on the top of the base under the uprights. The cross bars, B, were then put in place, and the cages, D, suspended, and the two courses were riveted together. The gin-pole was now laid aside, and the third course was put in place by the method to be used from that point to the top, the ease and facility of which are worth noting. In the arms, B, just back of the eye bolts to which the cages were suspended, were other eye bolts, E, into which was hung a snatch block, over which was passed a rope leading from the hoisting machine, and hooked into the sheet upon the ground. As the sheet was raised, the cage was swung out to allow it to pass up behind it, the sheet swinging naturally and easily into place, where it was secured with bolts. When the whole course was thus secured, the snatch blocks were hooked on to the top of the sheet as before, and the frame raised as before, so that the loose cross beams, A, could be laid in the stirrups, S, which had previously been bolted in place at the horizontal seam; and from this point up the frame, except when it was being raised, was resting upon the two cross beams, A, hanging in the four stirrups, of which there were two sets, so that while the frame was hanging in one the other could be transferred to the seam above. There was, therefore, no delay, for as each course was riveted up and another bolted in place ready for riveting, but a few moments were required to hook on the snatch blocks, raise the frame, transfer the cross beams, A, to the next set of stirrups, and drop the frame on to them. The sheet being riveted one-quarter round on the opposite side, the cross bars, B, were swung so that the cages covered the other two quarters, and the riveting was completed.

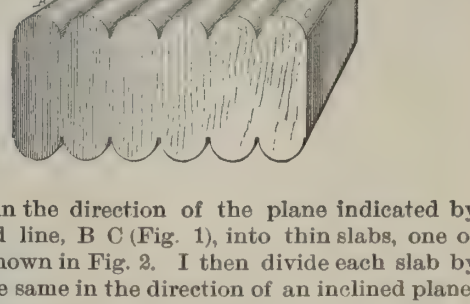
In this way this traveling stage, carrying eleven men, went to the top with no trouble whatever, the operations following each other in rapid succession, and within twenty-seven working days from the driving of the first rivet at the bottom the last rivet was driven at the top, including the hanging of three sets of guys and painting the chimney inside and out. A cast iron capping having been put in place, a permanent iron ladder was hung from top to bottom. The cages were then lowered to the ground and the frame taken apart and dropped, two pieces of timber being laid across the top, from an eye bolt in which were hung blocks and falls for the purpose of raising a platform which carried the masons and material for putting in an 8 in. lining, which was done in about twenty days. The blocks were then lowered and the cross timbers dropped, and a completed chimney stood as a testimonial of the quickest time on record for such a job. The total weight of the chimney, including the base, ring, and cap, is 100,105 pounds. The cost for the labor, including punching and rolling the sheets and straps, and all labor incidental to the erection, did not exceed two and one-tenth cents per pound.—*Amer. Arch.*

ORNAMENTAL CLAPBOARDS.

A new wrinkle, by Frederick Mankey, of Williamsport, Pa., is to obviate the use of shingles or small boards, which are now frequently employed upon the sides of cottages, to give variety to the exterior. As commonly applied, each shingle or small board is put in place separately, and this involves considerable labor. Such a siding is also apt to be not weatherproof, by reason of its numerous joints.

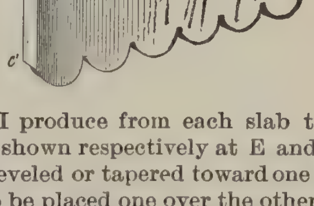
Mr. Mankey says: I take a block or bolt of wood of a thickness equal to the desired breadth of the clapboard to be made, and upon opposite sides of said bolt I produce a new configuration, such as elevations, A, extending transversely to the grain. The appearance of a bolt or block so cut on its opposite parallel surfaces is shown in Fig. 1. I then divide said bolt longi-

Fig. 1.



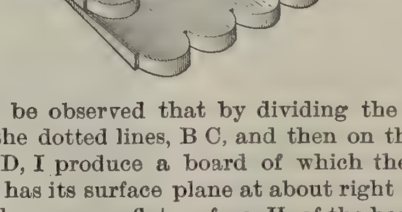
tudinally in the direction of the plane indicated by the dotted line, B C (Fig. 1), into thin slabs, one of which is shown in Fig. 2. I then divide each slab by cutting the same in the direction of an inclined plane, such as is indicated by the dotted line, C′ D, in Fig. 2.

Fig. 2.



In this way I produce from each slab two boards—such as are shown respectively at E and F (Fig. 3)—each being beveled or tapered toward one edge. These boards are to be placed one over the other in the manner of ordinary clapboards, as shown in Fig. 3, and are so secured upon the building.

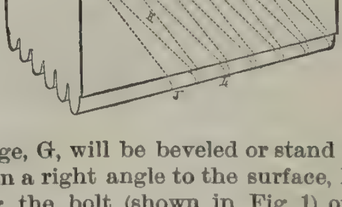
Fig. 3.



It will be observed that by dividing the material first on the dotted lines, B C, and then on the dotted lines, C′ D, I produce a board of which the thicker edge, G, has its surface plane at about right angles to that of the upper or flat surface, H, of the board.

Fig. 4 shows my mode of effecting the division so

Fig. 4.



that the edge, G, will be beveled or stand at an angle greater than a right angle to the surface, H. Instead of dividing the bolt (shown in Fig. 1) on a vertical plane following the line, B C, I here divide it on an inclined plane foll wing the line, I J (Fig. 4). After the slabs thus produced are separated, I divide each one, as before, on an inclined plane, represented by the line, K L.

It will b observed that clapboards produced by my foregoing process are not split or riven like shingles, and that the aid process allows of the utilization of all the material in th block or bolt. None is wasted by any planing operation, such as is ordinarily necessary to make smooth boards of tapering form. The cheapness and simplicity of this process will also be obvious, inasmuch as, after the bolt is cross-cut on its surfaces (which I accomplish very readily by means of rotary cutters), it is divid d into clapboards, ready to be at once applied, by merely the two saw-cuts.

To Remove Exudations from Brick Walls.

The simplest and least expensive method for removing saltpeter exudation from brickwork, when the efflorescence is in position where the sun and wind do not have free access, is to wash it off with diluted hydrochloric or common muriatic acid of commerce. About half a pound of the acid is used with an ordinary pailful of water, the application being made with a sponge.

PROPOSED FIRE ENGINE ELEVATORS FOR USE IN THE NEW YORK ENGINE HOUSES.

For some years the necessity of increasing the number of engines that could be called upon for the extinction of fires has been realized forcibly by the Fire Department of this city. Their power of doing this has been restricted by unfavorable conditions. The districts where increased force is most needed are crowded with houses, and property is held at a very high valuation. For each engine company a building 25 feet in front and of full depth is required. The department has not felt able to purchase new lots enough to carry out their desires.

Some years ago Mr. Henry D. Purroy, now president of the board, conceived the idea that by utilizing the cellars of engine houses the capacity of each might be doubled. At present the cellars represent little more than waste space. They contain a small heating apparatus, and the great part of their area, equal to that of the working floor, is useless. He proposed to introduce elevators that should be sufficiently powerful to raise and lower an engine or tender, or other apparatus, from floor to floor. If this idea were successfully carried out, there would be ample room for a second relay of men and horses on the upper floors, the extra apparatus would be stored in the cellar, and the working floor would be as unobstructed as it now is.

In the illustration we present Commissioner Purroy's idea in some detail. Sections of the cellar and working floor are made movable, and are connected by heavy stanchions, so as to preserve an invariable distance from each other. When the lower platform, sinking into a depression in the cellar floor, comes to a level therewith, the upper platform is flush with the working floor. Four guide posts run from cellar floor to the ceiling of the ground story. Upon the lower platform an extra engine or tender is placed. After the regular engine has been called out, the platforms are raised until the lower one is even with the working floor. By any simple lock ing device which may be automatic, the platform is caught and secured in this position. The second apparatus is then ready to answer a second alarm. Our illustration shows the elevator rising as the regular engine is leaving for a fire.

By counterpoising, the weight to be raised may be almost nothing. An engine represents some 10,000 lb. While this seems a large weight, it is an invariable one, and the elevator may be counterpoised within a few pounds of its load, and might even be overbalanced, so that the platform, on a catch being released, would rise automatically. For such lifting power as may be required, it was thought that a gas engine might be used.

The length of the stanchions should be so adjusted that the upper platform would strike the ceiling above or striking pieces attached thereto, and lock itself there as the lower one came to its place. This feature was included in the original idea, and appears a very good one.

With regard to the location of the elevator, it may be in the front or rear. If in the front, then its upper platform would always carry the regular engine. If in the rear, the upper platform would be unoccupied, and would count as floor space. As the lower engine rose, it could be run forward by man power or the horses could be harnessed as it stood.

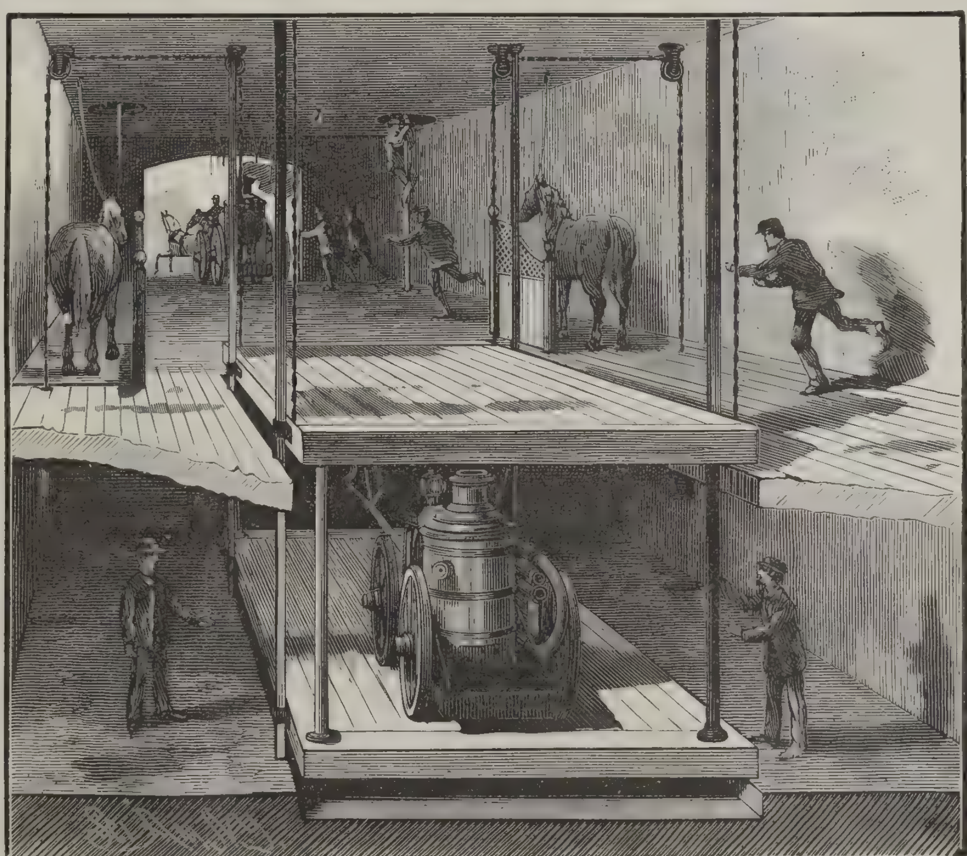
By having it of sufficient length, the extra engine could be carried up with its pole in place and the harness hanging from the snap hooks on the lower surface of the upper platform. On the other hand, as it takes but a moment to place the pole in its socket, the smaller elevator may be adopted.

The widest range for application of power and other details is still open. A direct or indirect hydraulic lift may be employed, or a windlass worked by some form of power would answer. The lower engine need not be kept upon the platform, but may be stored in front or rear of it, and be run on when the upper one goes out. To guide it between the stanchions and guide posts, Commissioner Purroy has proposed the use of rails on the platform, similar to those used on street railways.

The double platform elevator counterpoised is substantially the original idea, and presents, to our mind, very great advantages. Plans have been prepared by Messrs. N. Le Brun & Son, architects to the department, which involve the use of a single platform elevator, worked by hydraulic power. When the first engine has gone out, the elevator, whose platform has hitherto formed part of the working floor, is lowered to the cellar, receives its engine or other apparatus, and rises with it to the upper level. Such elevator may be worked by a short cylinder directly under it or by an indirect acting cylinder, such as is in use on most elevators.

For cities of a more regular shape than New York, this plan can be worked to even greater advantage. Three or four houses can be made to cover a large area if worked upon this plan. While it seems a peculiar merit of the method that it can be applied to old houses, the department, not wishing to risk a failure, have preferred to wait until a new house was to be built to test its merits. This is now soon to be done, and it promises to offer a satisfactory solution of a very troublesome problem.

The double platform elevator presents the advantage that the floor is always complete save as the lower engine is coming up. On the other hand, the single platform arrangement does away with the obstructing stanchions and guide posts. Each system, in other words, has its own advantages.



FIRE ENGINE ELEVATOR.

PHOTOGRAPHIC NOTES.

Improving Gelatine Emulsions.—Before the first annual Convention of Photographers of Great Britain, recently held at Derby, Mr. A. L. Henderson, well known for his exhaustive experiments in gelatine emulsions, spoke upon the advances which are being made in this direction. By means of the centrifugal machine he had, with one or two exceptions, remedied every spoiled emulsion that had been brought to him, and in those cases he believed the emulsions had been fogged by light.

He regrets that photographers, as a general rule, are so reticent and uncommunicative about any improvements they may discover. If there were fewer so-called trade secrets, photography, as an art science, would make much more rapid strides. He says:

Through this new departure, *i. e.*, using a centrifugal separator, I have gained more knowledge in six months than the whole previous year's experiments. By the complete removal of the colloid matter and soluble salts, I am enabled to examine the finely divided bromide, and then add other substances that I venture to think will still more revolutionize photography. I particularly allude to the addition of what may be called accelerators (physical or chemical) to emulsion. If an emulsion, being perfectly free from soluble matter, is boiled for a time, it will darken in color. The same emulsion might have been boiled as long in the presence of free bromide and nitrates without darkening. If in the former case I add some nitrate that will dissolve oxide of siver, and add some free bromide, I decolorize the emulsion, but I will not altogether eliminate fog, for this reason: the free silver (*i. e.*, I will call it free silver for argument's sake) has acted on the colloid before the addition of the free bromide, which has to play the part of reconversion, but, as I have previously stated, if both the nitrates and free bromide is present from the first, no chemical fog will result.

Some few years ago, Professor Stebbing published "that a washed bromide of silver coarsely precipitated, when boiled with the addition of free bromide, a breaking up of the granules took place." I tried this at the time without noticing this effect, but on my adding some gelatine a rapid breaking was the result, and I found that this occurred without the free bromide. It is very evident that the addition of fresh gelatine to a finished emulsion will frequently accelerate and sometimes slow it. Accelerate if the gelatine is neutral, and restrain or slow if it is acid. I have discovered that a finished emulsion may be ripened considerably by keeping it liquid, with the addition of a very small quantity of pure nitrate of potassium and bromide of potassium. My reason for suggesting potassium salts is that they are less deliquescent, and no harm will come over the plates prepared without the removal of the salts. The quantity must not be so large as to give any appearance of crystallization when the plates are dry. The larger the quantity, the finer is the emulsion in density, speed, and clearness of shadows. I generally add to every ounce of gelatine five grains of potassium nitrate and two of bromide. Here are two plates. You will see the effect; not only does the speed increase, but, strange to say, the density also. Both these plates have had the same exposure under the sensitometer tablet. I calculate the speed has been increased nearly four times. I am not quite sure if my explanation is correct, but it looks as if the very partial crystallization allows more light to penetrate the film and perhaps absorb certain rays less actinic. I think this idea will open a wide field of research, namely, that crystalline matter introduced in emulsion may take the place of the various substances recommended to give orthochromatic or isochromatic effects.

Here is another curious result occasioned by the mixture of a very rapid and a slower emulsion. You will see that the plate is covered with black spots. At first I thought that some impurity had got into the emulsion, but on close examination it will be seen that where there is no exposure, the black spots do not exist, showing that the black spots are silver compounds. The addition of nitrate of potassium and bromide caused a breaking up and possibly dissolving of the more sensitive particles (these particles are so fine that they have passed through a chamois leather filter). This will explain why an emulsion is more homogeneous and better for being set and remelted. I called attention to the fact some years ago that setting and remelting several times improved the quality of emulsion, although at the time I was not sure of the reason. I see that Mr. Plener has given it as his opinion that a putrid emulsion that frilled could not be cured by the removal of the decomposed gelatine. I differ with Mr. Plener in this matter. Mr. Plener, doubtless, made this statement, believing that frilling was produced only from decomposed gelatine. The most common cause of frilling is the subsidence of the silver bromide to the glass from slow setting. An emulsion that has become sloppy is usually coarser. I believe that Mr. Plener is, to a certain extent, correct regarding the re-emulsifying of the bromide after being passed through the separator. The addition of acids to the bromide of silver will remove all the gelatine, and, in fact, will permit the bromide to be washed in alcohol, and added to vehicles other than gelatine. If the gelatine is not perfectly removed, the granules of silver bromide will harden under the alcoholic treatment, and be useless for mixing with collodion; but they soften in water again, and are easily miscible in gelatine.

One word more regarding the keeping qualities of emulsion containing nitrates and bromide. The antiseptic properties of nitrate of potassium are well known to picklers of meat. I have some emulsion put away to test the keeping qualities. I am in hopes that at the next convention I may be able to show this emulsion, and tell you something more of its properties.

We have taken the foregoing extracts from the *British Journal of Photography.*

American Institute Fair, New York.

The 55th annual fair of the American Institute will be opened in the city of New York on the 29th of September, 1886. The building is now being put in order. The fountain in the center of the main building will be in operation this year, and will be illuminated by Edison electrical lights. There will be an unusual display of fine engines and labor-saving machinery of all kinds. The horticultural display will commence on the 6th of October.

RECENT determinations give light a velocity of 185,420 miles per second (Cornu), or 186,380 miles per second (Michelson).

Construction in Earthquake Countries.

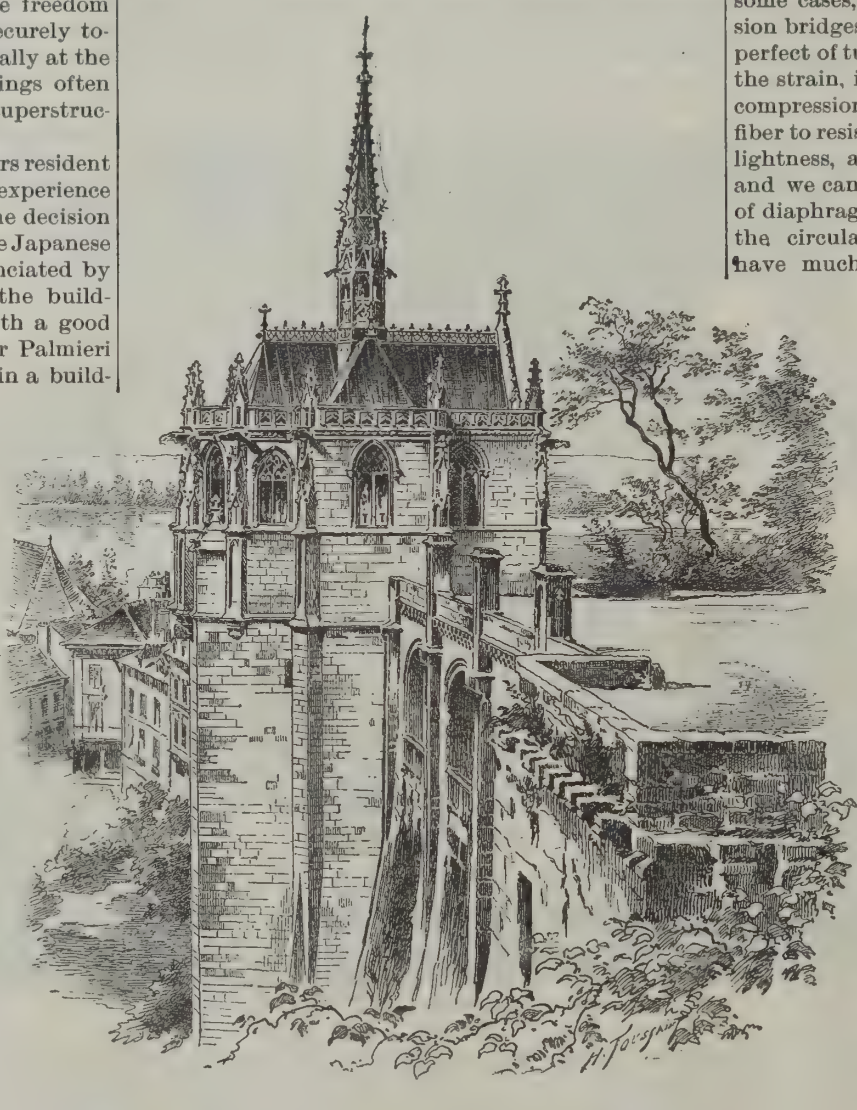
Professor Milne, of the Imperial College of Engineering, Japan, recommends that ordinary inexpensive dwelling houses should rise from a solid wall, which itself has a foundation deep enough to reach hard ground. If the ground be soft, and therefore liable to considerable motion, the house might rest on layers of cast iron shot, not larger than buck shot. Wooden houses are usually objected to, on account of their inflammability and their appearance. If angle and sheet iron be used as the building material, internal walls of wood and paper will be required. In a hot climate like Manila, three ceilings, with corresponding air spaces, are employed. Chimneys may be made of iron tubing. The dangers from fire may be reduced by using two tubes placed concentrically, with an air space between them. Before erecting heavy structures of brick and stone, much might be learnt respecting the nature of the proposed site by instituting a seismic survey. Such buildings ought certainly to have deep foundations, and if the basement had a lateral freedom, the motion to which the building is exposed would probably be reduced. He concluded his paper by enumerating the following principles, which ought to be followed in the construction of buildings: 1st, to provide against horizontally applied stresses; 2d, to allow all parts of the buildings, with different vibrational periods, either to have freedom among themselves, or else to bind them securely together with long steel or iron tie rods, especially at the floors and near corners, as corners of buildings often suffer in earthquakes; 3d, to avoid heavy superstructures.

Mr. R. H. Brunton, who was for many years resident lighthouse engineer, gave the results of his experience when engaged in carrying out his work. The decision at which he had arrived in his designs for the Japanese lighthouses was to follow the principles enunciated by Mr. Mallet and Professor Palmieri, to give the buildings weight and great inertia, coupled with a good bond between their various parts. Professor Palmieri stated that, although solidity and strength in a building did not afford perfect protection, still, so long as fracture did not occur, overthrow was impossible. Mr. E. G. Holthum, formerly resident engineer in the railway department in Japan, did not seem to attach much value to the elaborate observations which Mr. Milne had carried out, as he remarked that the conclusions which had been drawn from these observations were founded upon ordinary information and common sense rather than upon disclosures afforded by the experiments or the records of instruments. He remarked that ordinary engineering structures, such as girder bridges, arches of modern span, station sheds, and roofs, appeared proof against moderate shocks. None of the railway work executed in Japan previously to 1882 had suffered from the effects of earthquakes, the greatest damage coming within his notice, as attributable to two rather severe shocks in 1880, being the starting of a few facing stones attached to a timber framed building of the kind generally considered in Japan to be earthquake proof.

Mr. Henry Dyer, who, as principal of the Imperial College of Engineering, Japan, was interested either directly or indirectly with almost all the buildings mentioned by Mr. Milne, was of opinion that the supposed necessity for making special designs for buildings in earthquake countries had a very bad effect on the development of architecture in those countries, and that the main things to be attended to were good construction and a few elementary principles, which a short study of earthquake phenomena was sufficient to impress on any intelligent observer. From observation, both in Japan and on the continent of Europe, he could say that if more attention had been paid to construction and to those elementary principles, little or no damage would have been done by ordinary earthquakes.

Against extraordinary shocks, by which the earth was rent asunder, it did not seem possible to take any precautions. Mallet held similar opinions, for in reference to the Neapolitan earthquake of 1857, he wrote: "It was evident that had the town generally been substantially and well built, or, rather, the materials scientifically put together, very few buildings would have been actually shaken down, even in those localities where the shocks were most violent, and their directions the most destructive. Thus the frightful loss of life and limb was as much to be attributed to the ignorance and imperfection displayed in the domestic architecture of the people as to the unhappy natural condition of their country as respects earthquakes;" and he gave many examples of buildings in which the masonry was of the best class, and such as would be so recognized in England, which stood uninjured in the midst of the ruins of those constructed of rubble stones with large, ill-filled mortar joints.

After noticing the various buildings mentioned by Mr. Milne, Mr. Dyer concluded by stating that in his opinion, for dwelling houses in Japan, the modifications of external design required, as compared with those in Britain, arose not so much on account of the earthquakes as from the heats of summer, the colds of winter, and the typhoons of autumn. Iron roofs were good from a merely structural point of view; but in summer it would be impossible to live in the houses provided with them. If a non-conducting material of the same strength and durability as iron could be found, it might be used. Similarly, iron chimneys would be the causes of numerous fires, even when two tubes were placed concentrically with an air space, for careless workmanship, bad material, and corrosion would soon render them dangerous. If the houses were so designed as to be comfortable as regarded temperature, and the construction made in good brick, or equally strong stone and mortar, so that the walls were of nearly a uniform strength, if no unnecessary top weights were used, and if the various parts did not vibrate with different periods, they would withstand all ordinary earthquakes, and other precautions would be unnecessary, as these generally produced results more serious than those due to the earthquakes.



CHAPEL OF AMBOISE.—[See page 69.]

The Salt Mountain of Palestine.

BY SELAH MERRILL, LL.D., U. S. CONSUL, JERUSALEM.

Palestine possesses a remarkable salt mountain situated at the south end of the Dead Sea. The length of this ridge is six miles, with an average width of three-quarters of a mile, and the height is not far from 600 feet. There are places where the overlying earthy deposits are many feet in thickness, but the mass of the mountain is composed of solid rock salt, some of which is as clear as crystal. How far this deposit of salt extends below the surface of the ground, no one at present knows. At some points, this ridge, which is on the shore of the Dead Sea, approaches very close to the water, and at others it recedes until it is fifty or more yards from it. Just here the water of the Dead Sea is much more salt than it is at the north end, where the Jordan enters the lake.

This salt is a government monopoly. The same is true of the salt that is contained in solution in the Dead Sea itself. If Arabs or the natives of the country were found getting salt from the shores of the Dead Sea or from this salt mountain, they would be arrested at once. Most of the salt used in Hebron, Jerusalem, and elsewhere in this part of Palestine, comes from these sources, but it is gathered under the direction of government officers, and the revenue is supposed to go to the government.

In this salt mountain, to say nothing of the salt of the Dead Sea, there is a mine of wealth; and if capitalists were allowed to come in and work it, the prosperity of this part of the country would thereby be greatly increased.

I have examined personally this salt mountain, and talked with the Pasha of Jerusalem, who is also the Governor of Palestine, as to the desirability of companies being formed which should prepare this salt for use and ship it to the markets of the world; but at present the Turkish government is hostile to any such project.

Specimens of salt from this salt mountain were sent by me to the care of the Department of State, designed for the exposition at New Orleans in 1885.

Jerusalem, August 9, 1886.

Prototypes of Hollow Beams in Nature.

We have many instances in the vegetable kingdom of the extreme rigidity and strength of circular tubes; the stems of the grass tribe generally are remarkable for their lightness and strength. The common wheat straw and the river reed are familiar examples in our own climate; but in the tropics the gigantic stems of the bamboo and other grasses tower 60 feet above the jungle, and are extensively employed as beams for covering buildings, and even, in some cases, as the transverse bearers of light suspension bridges. The angler's bamboo rod is the most perfect of tubular beams. Tapered off in proportion to the strain, its siliceous coat (as in all the grasses) defies compression, while it is internally lined with woody fiber to resist extension in every direction. Its strength, lightness, and stiffness are thus equally marvelous, and we cannot fail to be struck with the provision of diaphragms throughout the whole tribe, to preserve the circular form, which addition would certainly have much modified the results obtained from thin circular and elliptical tubes of wrought iron. The bones of animals are oval, the depth being always in the direction of the transverse strain. But the more special province of the bones appears to be their action as pillars or struts, in forming immovable fulcra for the reaction of the muscles; and since any yielding would involve a great increase of motion in the muscle itself, we find bone among the most incompressible of known substances. The square form of stem characterizes a very extensive natural family of plants, the labiate tribe, of which the beautiful dead nettle of the hedgerows is an example, though it is difficult to assign any mechanical reason for this peculiarity, which appears rather to be typical of the general development of these plants. But in the feather-bearing part of the ordinary quill we have a most remarkable example of the strength of the rectangular form. Here, again, every dimension is tapered down in proportion to the strain, with an accuracy defying all analysis. The extended and compressed portions are composed of a horny substance of prodigious strength, though extremely light and elastic. The beam is not hollow, but, to preserve its form, it is filled with a pithy substance which replaces the clumsy gusset pieces and angle irons of the tube without interfering with its pliability. The square shaft is peculiarly available for the attachment of the deep vanes which form the feather, and, as the angular form would lacerate its active bearer, an exquisite transition to the circular quill at the base is another striking emblem of perfection.—*Edwin Clark, in the Architect (London).*

How to Restore Faded Inks.

The process consists in moistening the paper with water, and then passing over the lines in writing a brush which has been wet in a solution of ammonia. The writing will immediately appear quite dark in color, and this color, in the case of parchment, it will preserve. Records which were treated in this way in the Germanic Museum in Nuremberg, ten years ago, are still in the same condition as immediately after the application of the process. On paper, however, the color gradually fades again, but it may be restored at pleasure by the application of the sulphide. The explanation of the action of this substance is very simple; the iron which enters into the composition of the ink is transformed by the reaction into the black sulphide.

IT has long been a question of doubt as to how far beneath the surface the roll of the ocean could be felt. A diver at work on the Oregon at a depth of 120 feet found it so heavy that he could not keep his position while making fast to a trunk which was to be hoisted up.

Composition for Plastering, Filling, Wall Ornaments, etc.

William Horstmann, of the city of New York, has invented a composition to be used for filling the cracks in the plastering and woodwork of walls and ceilings, and also for hard-finishing walls and making ornamental center pieces and other wall ornaments.

Take sixty-four parts of whiting, and mix it with sixteen parts of water; then add four parts of dextrine, which has been first dissolved in water, also ten parts of boiled linseed oil, and three parts of brown Japan or any other suitable drier. A mass is thus formed having the consistency of a thick paste, which keeps in a moist state owing to the dextrine used, and which is packed up in cans and barrels, ready for use.

The composition is applied directly after opening the cans or barrels, without the admixture of water or other liquid, and used for filling the cracks of walls, ceilings, and woodwork. It dries slowly on exposure to the atmosphere, and forms then a firm and substantial filling for the cracks. When used as a hard finish, it is allowed to dry for from twelve to twenty-four hours, according to the thickness of the finish, after which time the wall can be coated with paint or calcimine. When used for center pieces or other wall ornaments, they have to be given time for setting and drying.

Relations of Architecture and Insurance.

Building materials considered in their fire-resisting qualities, brings fire clay first. It is cheaply made and inexpensively applied. It can be made in light forms, and can be used in places where brick cannot, on account of weight. Its air cells make it an ideal non-conductor of heat. Brick is the second in importance. Its cheapness, ease, and certainty of use, artistic effects in finer forms, all make it among the noblest of building materials. Terra cotta is classed with brick. Iron has not held its own. We cannot do without it, but we cannot trust it when freely exposed to a high degree of heat. When used as girders, the danger is very great, because the tensile resistance of the metal is so much lessened. Even if the deflection is inconsiderable, it will probably be enough to drop floor joists resting on them, or, in case of columns, to throw the direction of weight out of the axis of the column, and so break or overturn it.

There would be greater security in store fronts if the iron girders or lintels were covered with fire clay. In all cases where iron has weight to carry, it should be protected from heat. Fire clay covering is best. Asbestos, or wood, provided there is no air space between the wood and iron, is better than nothing.

Stone is the highest of all building materials in an artistic sense, but it takes second place to brick as a fire-resisting medium. It is of great consequence to know the action of heat on stone, or when cooled by the sudden application of water. Quarry owners should furnish reports of tests of their stone under fire. When stone is used for piers, and its fire action is unknown, the pier should have considerable excess of size. Where such stone is used for wall-facing, the brick wall which "backs" it should be strong enough to secure perfect stability without the stone.

Wood, when cut thin and surrounded by an air space, is very inflammable, but in large masses burns slowly. It has the advantage over iron in that the application of heat impairs its area only, without destroying its carrying efficiency. Wood may be protected and combustion retarded by creosote and other devices which are often treated by architects and underwriters with neglect.

Asbestos, mineral wool, and plaster of Paris are exceptionally good materials to retard the progress of fires. Glass and paper, properly protected, are coming into greater use.

What are the most prominent reasons for the total destruction of buildings by fire? They are, facility furnished for the rapid and unobstructed spreading of flames, which we may call "flues," and, second, the falling out or in of parts of the burning building, which we will call "leverage."

As to flues: In all our common wooden houses the sides are composed of flues, generally open at top and bottom. The same is true of nearly all brick houses, where, for reasons of cold and dampness, all inner surfaces of the walls have small wood strips set against them, to which are nailed the laths for plastering. This is, in America, the Universal Insurance Company Destroyer, *Unlimited*. Elevator shafts and soiled linen chutes often supply a large flue or shaft to connect all the others.

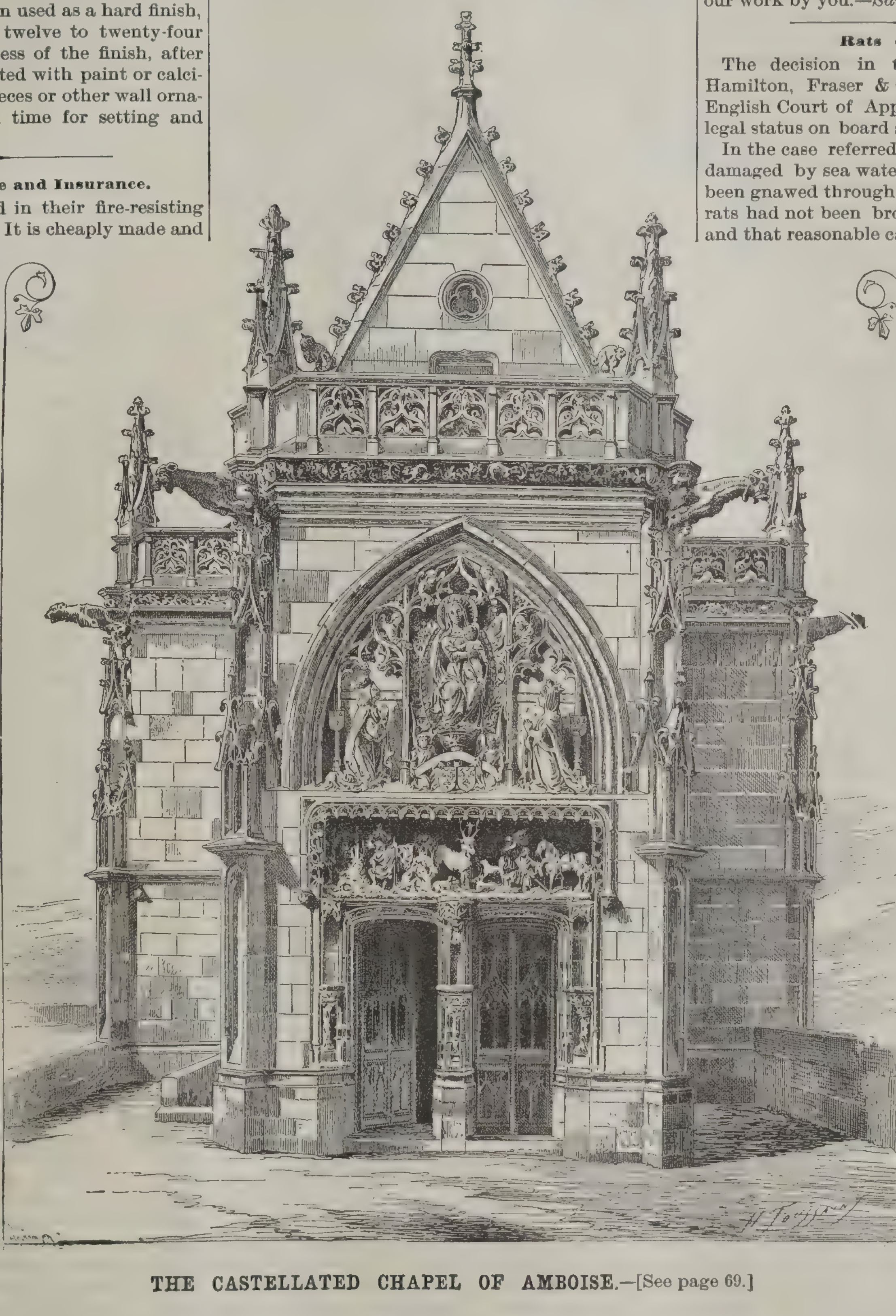
In all these houses, the fire is first seen in the roof, but it almost always starts almost anywhere else.

It is not cheaper to build in this way. The first plan should be to make the flue as fireproof as possible, and stop it up with something that will not burn. At the line of the various floors run out a board between the studs of the partitions, or between the furring on the brick walls. Fill up this board two inches deep with the mortar left from the masonry and plastering, and the difference between this and the common form of wood or brick house is that this house, if it catches fire, can be saved; the other cannot. If the wood studs or furring strips have an inner lining of asbestos paper, or an outer lining also for wood houses or partitions, the security is just that much greater. The flues in the floor should be broken by fire-tile bulkheads. The shafts for elevators, lifts, chutes, and other similar purposes are more malevolently designed, but not more dangerous. Their walls and doors should be as nearly non-combustible as possible, and should close automatically. The shaft should in all cases continue through the attic and out of the roof, having its top closed with some substance that will readily break if fire be in the shaft; or the top should be tightly closed with fire-proof material.

As to the leverage: Walls of buildings are generally forced over by some form of direct leverage. The floor joists or beams generally have with the outer wall some fixed connection which, when the action of fire causes the beams to fall down, holds them to the wall, forcing the wall to "buckle" and fall out and in. The mechanical power for destruction of a weight thus applied is very great. Falling under the application of this strain the wall need not necessarily fall inward; but if applied at top or bottom, several reasons may make it fall both ways. It should be insisted by underwriters that a method of anchoring wood joists to walls be used of such character that falling of the joists shall free this anchorage and leave the walls standing.

The lateral tying together of walls, so that it becomes difficult for walls to break away from each other, does not cost much, and often makes great difference in the income of insurance companies.

The relationship between architecture and fire insurance will be finally and happily adjusted at the moment when frank recognition of your interests by us is met by equally frank recognition and criticism of our work by you.—*Sanitary News.*



THE CASTELLATED CHAPEL OF AMBOISE.—[See page 69.]

Rats on Board Ship.

The decision in the case of Pandorff & Co. vs. Hamilton, Fraser & Co., recently pronounced in the English Court of Appeal, has deprived the rat of all legal status on board ship, if he ever had any.

In the case referred to above, a cargo of rice was damaged by sea water from a bath pipe which had been gnawed through by rats. A jury found that the rats had not been brought on board with the cargo, and that reasonable care had been taken to prevent their coming on board, and Mr. Justice Lopes, before whom the case was tried, gave judgment for the ship owners, apparently on the ground that the action of the rats in gnawing through a leaden pipe and letting in the sea water upon the cargo was a matter beyond all human control; in his own words, it was "a case of sea damage at sea, and nobody's fault." But the judges of the Court of Appeal were of opinion that, "as a rule, rats can be kept out of ships which are fit to carry cargo; and, speaking broadly, a loss which is due to leakage caused by rats will probably be found to be due, not to the perils of the sea, but to the defects of the ship or the want of precautions of the ship owner;" that the mischief done to a pipe, and the incursion of sea water which followed, would never have happened but for either a defect in the condition of the ship or some want of providence in the ship owner or his servants. They therefore reversed the decision of the court below, and gave judgment for the owners of the cargo, with costs.

The old law laid down by Roccus was, that "if mice eat the cargo, and thereby occasion no small injury to the merchant, the master must make good the loss, because he is guilty of a fault. Yet if he had cats on board, he shall be excused."

We cannot find that the court entered into the question whether there was not want of reasonable care in leaving a leaden pipe exposed to the attack of thirsty rats, whose habit of gnawing through that metal to get at water is as well known as most other habits of that interesting creature. The court was content to find that the rats had no *raison d'etre*. There are other metals of which pipes can be made besides lead; and if the result of this trial should be to cause ship owners to make use of a more trustworthy material, or to incase lead pipes in a material which rats will not gnaw, an important step in the direction of safety will have been taken.—*Naut. Mag.*

MARBLE may be stained or dyed of various colors by applying the solutions mentioned below to the stone, made sufficiently hot so that the liquid will just simmer on the surface. Blue, tincture of litmus; brown, tincture of logwood; crimson, a solution of alkanet root in oil of turpentine; green, tincture of sap green; red, tincture of dragon's blood or cochineal; yellow, tincture of gamboge or turmeric. Success in the application of the colors requires considerable experience.

Palace of Artaxerxes.

After five years' exploration, M. Dieulafoy has succeeded in unearthing the remains of the palace of Artaxerxes and Darius at Susa, and the French archæologists are anticipating many valuable additions to the Louvre collections from the excavations. The work was conducted amid repeated attacks from brigands and fanatics, who allege that M. Dieulafoy was violating Moslem sepulchers. The palace of Artaxerxes appears to have been constructed on the site of the palace of Darius, and it is said to have some affinity with Greek work.

OLD ENGLISH FURNITURE.

The dissolution of partnership between Messrs. Wright and Mansfield has occasioned the sale of the whole of the stock of furniture collected by them. The first portion was sold on the 30th of June, and the remaining part on the 7th July. The best examples of Sheraton and Chippendale form part of their latter sale, and also a whole room from a house at Littlebury, built by Charles II. for Nell Gwynne, from the design of Inigo Jones. We hope to give some details of this room in a future number. The large Chippendale mirror we illustrate was an average example of a good many which were on view; it was heavily gilt, and in good preservation. The oak chair under is a copy from an old example, and the ribbon-back armchair is one of a good old set. A marqueterie piano, designed by Messrs. Wright & Mansfield, and the interior made by Erard, fetched 220 guineas.—*Building News.*

OLD ENGLISH FURNITURE.

The Inventor of Hydraulic Cement.

In his first essays M. Vicat made use of synthesis. Every one who had remarked how much the crystalline or molecular condition modified the physical properties of certain bodies could not give more than a limited confidence to the advantages likely to be gained by architecture from the chemical analysis of limes. The experiments of M. Vicat were directed straight to the object in view. The natural limes of Senonches were the type of perfection. M. Vicat composed an artificial lime, superior to that of the Senonches. He obtained this great result by calcinating in proper proportions chalk or pure lime mixed with clay. By this experiment light succeeded to obscurity, certainty to doubt. The art of building had received the accession of an admirable discovery. We do not suppose that the merit can be contested. It may be proved incontestably that M Vicat was not less really the discoverer in the subject of hydraulic limes than Newton was when he published the "Theory of the Composition of White Light," or than Franklin was when he proposed lightning conductors to the civilized world. The great Smeaton vainly tried to render rich lime hydraulic by the addition of clay, without preparation. Smeaton, mistaking, after repeated trials, the necessity of roasting the clay, showed, moreover, more clearly than all reasoning could do, the immense distance which separates simple appearances from realized and complete discoveries. M. Vicat occupied himself with equal success in investigating the properties of cements. Architects distinguish cements from mortars by their natural appearances. The sand contained in mortar exists there in the form of gravel more or less coarse, and more or less apparent. The composition of cement appears homogeneous, although it contains lime, silex, and alumina.

No substance has gained more celebrity among builders than that known at the present day as Roman cement. This cement, called originally aquatic cement, was made in the year 1796 by Messrs. Parker and Wyatt. It was the result of subjecting to heat certain nodules of limestone of an ovoid form found in great abundance at some distance from London. Roman cement, mixed rather thick, solidifies in a few minutes either in air or water. There are certain works, the Thames Tunnel for instance, which could not have been executed without Roman cement. Under other circumstances this rapid solidification is a real obstacle, and in such cases it is necessary to substitute hydraulic lime, of which the price is much less. Parker and Wyatt manufactured their cement, and found a sale for it throughout Europe; builders used it, but no one took notice of the real cause of its singular properties. The discovery of this cause belonged incontestably to M. Vicat. We find, in fact, that after having indicated the proportion of clay which renders lime hydraulic, the skillful experimenter published, in 1817, the categorical observation: "When we increase the proportion (of clay) to 33 or 40 per cent, we obtain a lime which does not slake; but it pulverizes readily, and produces, when wetted and mixed up, a composition which quickly sets under water." The proportion of clay indicated is precisely that of the substance manufactured by Parker and Wyatt. M. Vicat made, then, from 1817, every kind, not only of hydraulic lime, but also of Roman cement. To render rich lime hydraulic, it is sufficient to wet it in proper proportions with pozzolana or tarras. What more simple or convenient mode could be imagined? But in many localities the expense of conveyance renders it impossible to use either pozzolana or tarras. Many attempts have been made to prepare substances which possess the same properties. Chaptal thought he had resolved the problem by very much calcinating certain schists or ocherous clay.

But even supposing the properties of tarras and pozzolana to be reproduced in this manner, the difficulty was only shifted. The schists experimented on by Chaptal are not common in France; and there is, moreover, in the operation recommended, even if ocherous clay be employed, one circumstance which opposes an irremediable difficulty. It is the very high temperature requisite. M. Vicat resolved the question into its elements. This solution is as follows: Artificial pozzolana, superior or at least equal to the best Italian pozzolona, may be obtained by a simple manner of using clay of the purest kind. This method consists in slightly calcinating the clay, in merely driving off the water of combination, and always keeping the temperature between 600° and 700° Centigrade (1,112° to 1,282° Fahr.). The mind rests with satisfaction on the solutions of problems of practical art when they possess this admirable simplicity. On the other hand, one is astonished to see an operation so easy that the workmen call it a *tour de main* enrich a kingdom, or rather the whole world, with a substance eminently useful, and which appeared as if it must inevitably remain the privileged property of a corner of the earth once the seat of volcanic eruptions. —*F. Arago.*

To cleanse and whiten harness lines made of Russia leather, sponge the leather with dilute solution of oxalic acid, and then dress well with oil. The acid must be used sparingly, as it never benefits the texture of leather.

Revelations of the Earthquake.

The corps of United States Engineers who have been examining the shattered houses have found that nine-tenths of the brick buildings have been built of faulty material, and in an utterly unsafe manner. The mortar used was made of yellow clay and lime, and was consequently unfit to hold the bricks together. Again, it is found that the brick walls were loosely built, the space between the outer and inner bricks being filled with bats loosely thrown in so as to meet the requirements of the law prescribing the thickness of walls. The Craft School, a handsome public building, constructed only two years ago at a cost of about $20,000, is utterly wrecked, and, the engineers say, solely in consequence of the material used in its construction. The subject has been brought to the attention of the City Council, and a law will be passed prohibiting the construction of such buildings in the future, but in the mean time several of the builders are using the same old material.

A very grave phase of the situation is the scarcity in the city of skilled mechanics. This would be a golden opportunity for bricklayers, plasterers, tinners, and carpenters of the North and West. There are over 3,000 houses in the city which will have to be almost entirely rebuilt. The winter will be here in six weeks or two months, at the furthest, and the work of repairing has as yet made but little progress, although very nearly all the able-bodied men in the city are at work. Bricklayers are getting from $5 to $6 a day. In some cases, where repairs are imperatively needed, plasterers are receiving $8 a day. These prices, of course, cannot be kept up, but there is abundant room here for 500 skilled mechanics, who for six months at least could make double and treble the wages that they are now receiving.

The repairs on the historic St. Michael's Church have developed a strange fact in connection with the earthquake. The steeple has sunk about 8 or 10 inches, and in a dead level, as is proved by the fact that the pendulum clock in the tower has been started and is still running. The rest of the church evidently stands where it was, but the steeple, which is built on its own foundation, has sunk about 8 or 10 inches. Those who have visited St. Michael's will remember that on entering the vestibule they had to ascend a step of about four inches. Now the floor of the vestibule is about six inches below the sidewalk. Another curious fact is that the entire southern portion of the city seems to have sunk. Before the earthquake, Meeting Street, from Broad Street to the Battery, was a dead level stretch. Now, one standing at the corner of Broad and looking down Meeting Street stands apparently at the top of a hill, showing that the southern portion of the city has sunk.

Strength of Beams.

In a simple rectangular beam the strength varies as $\frac{b\,d^2}{l}$; or, in other words, the strength of one beam compared with another is, first, directly as the section of fracture; secondly, directly as the depth; and, thirdly, inversely as the length. And it possesses these properties independent of the nature of its resistance, so that, by direct experiment with any given beam, we can determine the strength of any other beam of the same material. Experiments have been made on beams of every kind of material; and to simplify the calculation of other beams from these, the results have been reduced to those which would be obtained from beams 1 inch square and 1 inch long. Thus a beam of cast iron of these dimensions breaks with 11 tons on it (Hodgkinson); of wrought iron, 13 or 12·264 tons (Barlow); of red pine, 2·4. Knowing, then, the breaking weight of this 1 inch beam, to find the strength of any other similar beam, we have simply (1) Multiply this breaking weight by the sectional area of the new beam; (2) by the depth of the new beam; (3) divide this product by the length, using inches for each dimension. Taking, for example, a beam 8 feet long, 12 inches deep, 1 inch broad, we have for wrought iron:

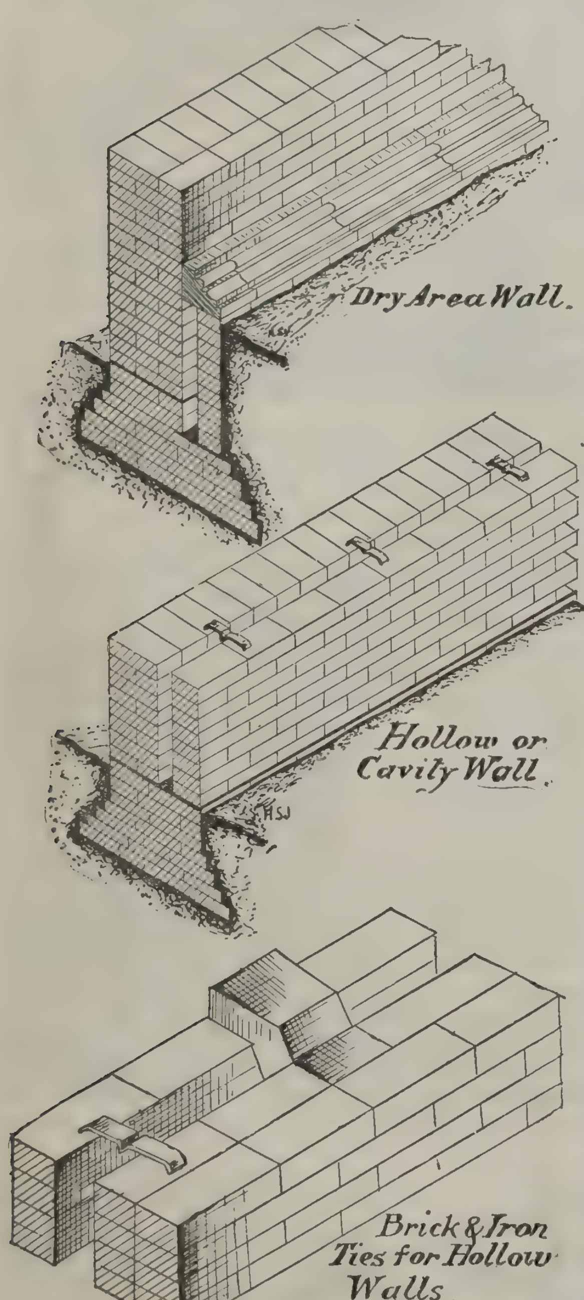
$$\frac{\overset{\text{Constant.}}{13} \times \overset{\text{Area of Section.}}{12 \text{ inches}} \times \overset{\text{Depth.}}{12 \text{ inches}}}{\text{Length, 96 inches.}} = 19{\cdot}5 \text{ tons.}$$

It is frequently more convenient to divide by the length in feet instead of inches, in which case these constants must be divided by 12, and in this form they are usually tabulated in works on the subject.—*Edwin Clark.*

DAMP HOUSES.

There are few more perplexing problems with which an architect or builder has to deal than that of effecting a cure for damp walls. In construction an almost equal difficulty is often found in building a dry structure, especially in the case of houses built on clayey soils and in isolated positions. A damp wall or a damp room is so unpleasant, destructive to its contents, and very unhealthy, that perfect dryness should always be one of the first considerations of the architect. The subject may be considered from the two points of how to erect a dry building and how to cure a damp one already erected.

It is with walls built underground, to inclose a cellar or underground apartment, that the trouble is most persistent. The walls having the earth resting upon them on the outside will be sure to be more or less damp unless proper precautions are taken in construction. There are two principal methods which may be adopted for walls so situated. The first is to cover the whole of the outside of the wall below ground with a bituminous asphalt, to protect it from contact with the earth; and, where necessary, as in the case of clayey or other soils retaining moisture largely, to insert open



drain pipes in the ground, close to the wall, to drain, as far as possible, the ground immediately around the site.

The second method is the safer one, and consists in forming a dry area around the whole of the building, as shown in the engraving. A wall half or one brick thick, as may be necessary, is built about two or three inches distant from the main wall, and the cavity is covered in immediately above the ground line with moulded bricks, forming a neat and ornamental finish. Where it is required to save the expense of moulded bricks, ordinary rough bricks may be laid in cement at an angle over the cavity, and be lightly covered over with earth, so that they may not be seen.

The bottom of the cavity is formed of Portland cement, asphalt, or some other suitable substance, and is laid with a proper fall, and connected with the drains, or, at least, is provided with proper discharge holes, for the escape of any water which may find its way in through the outer wall. A damp-proof course of a material impervious to moisture should always be built in the wall, on a course immediately above the ground line, to prevent the damp rising. Where the nature of the soil demands it, the open drain pipes before referred to may be employed in addition for draining the surrounding site. Care should always be taken, whether these drain pipes are employed or not, to grade the earth immediately around the building in such a manner as to throw the water away from the walls.

It will be understood that the dampness of walls is usually owing directly to the absorbent qualities of the materials of which they are composed, and hence houses built of inferior bricks, which are always absorbent to a considerable extent, cannot be expected to be dry, and especially if they are in isolated positions, where the walls are exposed to the full blast of the weather. Even where good materials are employed, the same effects may be noticed in exposed buildings.

The best construction for a brick building in such positions is the employment of the hollow walls, as shown in the sketch, which are carried up throughout the whole of the structure. Their efficiency depends, as in the case of the area walls, upon forming a cavity. Two walls, or casings, are erected side by side at a distance of about three inches apart. They are connected together with iron, brick, or other ties, inserted at intervals of about 30 inches, and the bottom of the space between the two casings is constructed as in the case of the area wall, to form a gutter which is connected with the drains. A damp-proof course is provided, and may with advantage be made on the level of the cavity gutter, so as to answer for the two purposes. The few courses of bricks between the damp course and the footings are built solid, the bricks being cut to form the necessary width. Various ties for connecting the casings are in the market, two of which are represented in the sketch. That formed of brick is moulded so as to rise a course front to back to prevent the water from creeping along it, and the iron tie is provided with a middle indentation for the same purpose.

Properly constructed, these cavity walls are quite effectual in rendering a building dry. They should always be employed for buildings standing by themselves. Strips of lead, tin, zinc, or other metal must be placed over all door and window openings, being bent so as to throw any water falling upon them into the gutter below. Cavity walls cost very little more than solid ones. The quantity of bricks used in the construction is almost the same, the only extra materials being the ties and the guttering. Besides keeping the building dry, hollow walls have the advantage of rendering the interior of the house less affected by changes in the temperature, rendering it cooler in the summer and warmer in the winter; a considerable advantage in a variable climate like this. The hollow space, moreover, lends itself very readily for the purposes of ventilation.

Dampness will sometimes be found to arise from the soil below the floor, and in building upon such soils the whole site should be covered in, beneath the lowest floor, with dry earth, or, better still, with a thin layer of concrete, which will prevent the damp rising from that source.

Referring now to the cure of damp buildings, it will nearly always be found to be at the best a troublesome matter. Sometimes the building will have been erected without a damp course, and the insertion of one, by underpinning all around the building, will, in such cases, generally effect a cure; or it may penetrate through the walls, either in the case of a cellar wall, from the earth resting against it, or from the rain beating through in the stories above. In the first case, it may be removed by digging away the soil around the building and erecting a dry area wall, such as that before referred to, but as this is always quite an expensive way, a simpler method may be tried. See that the earth around the building is properly graded, construct small air shafts at frequent intervals, inserting air bricks above the ground line, so as to place the space beneath the floor into direct communication with the outer air. This may be sufficient of itself, but if the wall is plastered and still shows signs of dampness, proceed as follows:

Hack off all the plaster from floor to ceiling. Place a stove in the middle of the room, and keep up a large fire, night and day, until the walls feel quite dry to the hand. Then render the walls in plaster composed of nearly neat Portland cement.

The writer has cured some obstinate cases in this manner. Re-rendering the plaster is expensive, and various paints and washes are in the market for application to the face of the plaster to keep out the damp. Some of them are effective, but the success of all depends upon the very simple precaution of stripping the whole of the paper from the walls and getting them dry before applying the wash or paint. In some cases the dampness will be found to rise some two feet only from the ground, and a cure has been attempted by painting the wall or applying lead foil beneath the paper to that height; but the method is useless, for the damp will only rise and show itself above the line of foil or paint.

In outside walls, dampness will sometimes show itself in small patches here and there, and sometimes in quite large patches. The small patches probably arise from a few bricks of inferior quality, which have inadvertently been built in the wall, and a cure can generally be brought about by covering the space on the inside of the wall beneath the paper with lead foil, using it to cover a space about six inches beyond the actual space of dampness. Where large spaces on the wall show damp, it may arise from defective gutters, from bad bricks, want of pointing, or other causes. Remove the cause, if possible, and if that cannot be done, the following remedy will prove of use: Melt 3 pounds of strong soap in 4 gallons of water, and carefully apply to the wall, so as not to produce a lather. Mix half a pound of alum with 4 gallons of water, allow it to stand for twenty-four hours (by which time the soap will be in a condition to receive it), and carefully apply as before.

The editor will be glad to receive communications on this interesting subject. A. S. J.

BRIDGING.

The object of bridging floors is not only to prevent the joists overturning; it is principally to distribute the weight resting directly on one joist over those joists immediately adjacent, and in that way to considerably stiffen the floor as a whole. The pieces of timber of which the bridging is composed may, and do, act either as ties or struts, according to the manner in which the

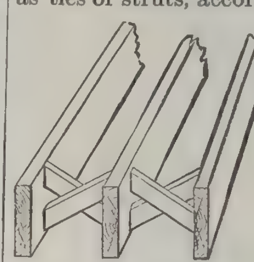


Fig. 1.

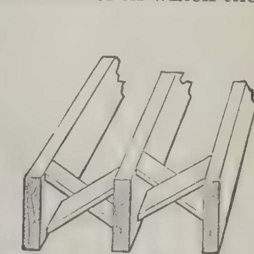


Fig. 2.

load is centered; and in the case of a moving load, as of a person passing over the floor, will act alternately as ties and struts in quick succession. The strutting being placed obliquely to the joists, the strain is practically neither that of a direct tie nor of a direct strut; that is, neither simple compression nor simple tension in either case, but is in both modified by a cross strain. There is some tendency for the joists to turn over, which augments the cross strain, so that, of the three stresses, the cross strain is of most importance.

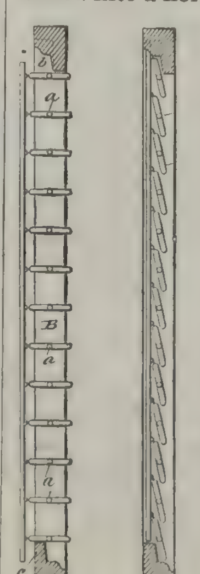
Now, it is a very well known rule that the strength of a beam or a piece of timber subjected to a cross strain is directly as its breadth and as the square of its depth; and it will be obvious, therefore, that the system of placing the bridging with its greatest scantling vertical, as shown in Fig. 1, is the proper one, and is a good deal stronger than the system usually employed, as shown in Fig. 2. In the first system the bridging is reversed alternately, so that the pieces may butt against the joists at points directly opposite one another, which tends to further strengthen and stiffen the floor.

The only advantage in the second system over the first is that it does not necessitate a man turning round to nail the pieces alternately as he comes to them, and therefore is saving of a small amount of time. But when it is considered how much additional strength is obtained by the first method, it will be seen that the saving of time under the circumstances is by no means a wise economy.—*Building.*

AN IMPROVED WINDOW BLIND.

BY CHARLES W. RADFORD, OSHKOSH, WIS.

In blinds as ordinarily constructed, the slats may be turned into a horizontal position by means of the rod, where they are retained by the friction of the slats in their bearings in the stiles; but when the blind becomes worn, the slats will not be retained in this position if disturbed by wind or jarred in any way, as the slat-operating rod will fall, and turn the slats so as to close the blind.



This invention obviates the difficulty by extending the upper and lower rails of the frame of the blind, so that they will be engaged by the upper and lower slats when the slats are in a horizontal position.

If the improvement be applied to the lower rail only, it will be effective in holding the slats in an open position. It is obvious that where the blind is provided with one or more rails intermediate between its ends, these rails should be formed with tongues, *c*.

The sketch shows a blind in open and closed positions.

A RECEIPT for frosting silver jewelry.—Dip the article in a solution of nitric acid and water, half and half, for a few minutes, then wash well in clean water and dry in hot sawdust. When thoroughly dry, brush the sawdust away with a soft brush, and varnish the parts required to be bright.

FROST ON SHOW WINDOWS.

The accumulation of frost or ice on show windows is so objectionable, both from the manner in which it renders a window useless by obstructing the view and from the damage it does to goods on a thaw occurring, that a number of contrivances have from time to time been brought out to overcome the trouble. The obstruction of a store window often means a serious loss to the proprietor, and especially in cases where the stores are located on leading thoroughfares, where the rent is generally very high and where the principal trade done is from the window.

Among the various devices which have been tried is one in which a transparent fluid, such as glycerine, was spread over the inside of the glass, thereby preventing the frost forming upon it; but the system was not a great success. The immediate cause of the form-

WOOD'S APPARATUS FOR PREVENTING THE ACCUMULATION OF FROST ON SHOW WINDOWS.

a on of the ice being the condensation of vapor upon the cold glass, it was sought to cure the evil by warming the glass by various means; in one case, by a row of gas or lamp lights placed along the bottom of the window. The extreme heat at the edge of a large sheet of glass would, where this system was adopted, often cause it to crack, and many a valuable sheet has been destroyed in this way. A further objection to the system was the manner in which the vapor would condense on the windows above the point heated by the lights.

The system of E. A. Wood, lately patented, solves the problem perhaps more perfectly than any other before attempted. In it a continuous current of dry and warm air is admitted through a narrow slit running the entire width of the window. The air passes in close proximity to the plate of glass, and rising to the ceiling forms a wall, or barrier, to keep the moist air in the room from contact with the cold glass, and is most effective in keeping the window perfectly clear and free from condensation in all weathers.

The heat may be obtained from furnace, steam, or any other convenient source, and in cases where no such heat is available, a special "window furnace," manufactured for the purpose, may be employed.

The Utica Steam Gauge Co., of No. 86 Fayette Street, Utica, N. Y., have the patent in hand, and are manufacturing and fixing the apparatus with much success.

To produce cold in a small ice chest without the use of ice, use one of the numerous freezing mixtures, such as equal parts of ammonium nitrate and water, or eight parts of sodium sulphate with five parts of hydrochloric acid.

Cleaning Stonework.

A process devised by M. De Liebhabert, used for cleaning the stone walls of the quays of the Seine, is worth noting. The walls became begrimed with a slimy, black deposit, which resisted acids. A paste composed of a solution of soda and lime, to which a little chloride of lime is added, was mixed to the consistency of honey, and spread over the surface and allowed to remain two or three hours. When removed, the surface was still black, but it had become sensitive to acids. After this treatment, a mixture called sulpho-chlorhydric was passed over the surfaces with a large gutta-percha brush, which formed a kind of glue on the stone; afterward the surface was syringed with a jet of the same liquid. This formed an adherent paste, which was afterward scrubbed off the surface; a hose or pipe being lastly employed to clean the work. The sulpho-chlorhydric mixture is composed sulphuric and hydrochloric acids mixed empirically, according to the necessities of the case.

Weight of Iron Girders.

It will be useful to have some simple rules for ascertaining the weight of tubes or beams of wrought iron. The following are on the assumption that 1 cubic foot of wrought iron equals 480 pounds. First, the sectional area in square inches of any tube, bar, or plate of wrought iron multiplied by 10 will be the weight in pounds per yard of length. Thus, an angle iron whose section is 3·5 square inches weighs 35 lb. a yard. In large masses or tubes, multiply the sectional area in square inches by the length in feet, and divide by 672 for the weight in tons. To reduce cubic feet into tons, multiply by 1½ and divide by 7. A deduction of one-twentieth from these results will give a close approximation for cast iron.—*E. Clark.*

MOORISH FRETWORK.

The use of screens or fretwork has become so general as an interior decoration that the accompanying design of a transom intended for the top of a doorway will prove of interest to our readers.

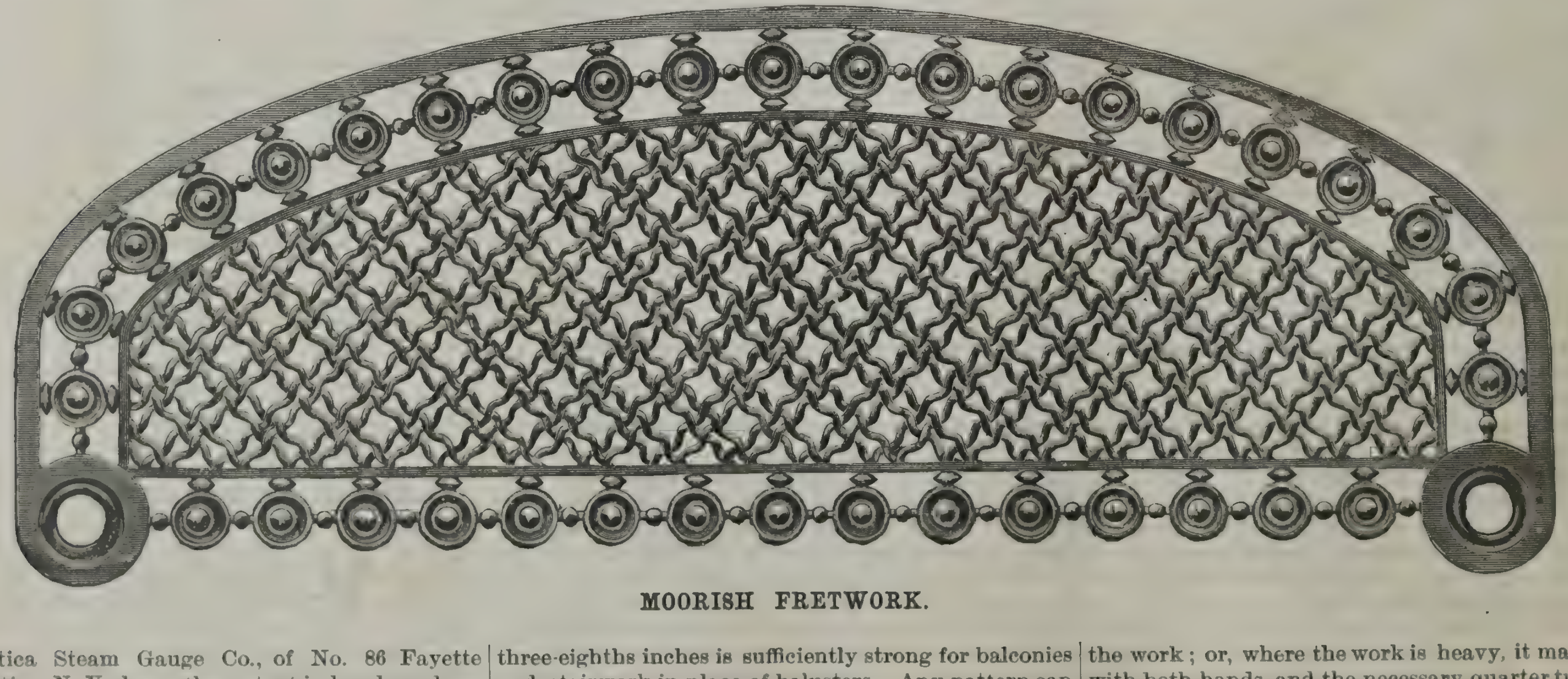
The work of which this is an example has been introduced under the name of "Moorish Fretwork," and is so called from the fact that its members are either interlaced, interwoven, or intermixed, presenting the appearance of the masses of ornamental work used in the Moorish system of decoration as exemplified in the Alhambra at Granada.

By cutting any good domestic wood into strips, and then into various spiral forms, in such a manner that they will interlace or weave together, an almost unlimited variety of beautiful patterns can be produced.

These threads, or strands, are cut from one-quarter of an inch to four inches in diameter, and can be cut six inches in diameter, thus forming a screen of either great delicacy or of broad, bold work. They may also be woven nearly solid, or as open as may be desired. It will readily be seen that, although each strand of one-quarter inch in diameter would be very brittle and easily broken, yet, when woven, it possesses great strength. The illustration represents a transom made from pieces five-eighths of an inch in diameter, and this size is the standard most commonly used for interior work.

This same work of one and one-eighth to one and three-eighths inches is sufficiently strong for balconies and stairwork in place of balusters. Any pattern can be made of one unbroken panel of any size, only limited by the capacity of car to transport it to its destination.

These frets are finished in furniture finish, or are put into tints, gold, or bronzes, and are manufactured by C. S. Ransom & Co., Cleveland, Ohio, who are protected by patents on the machinery and also on the product.

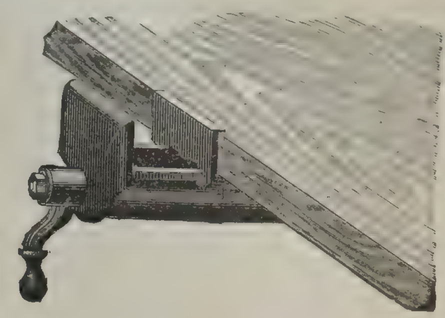


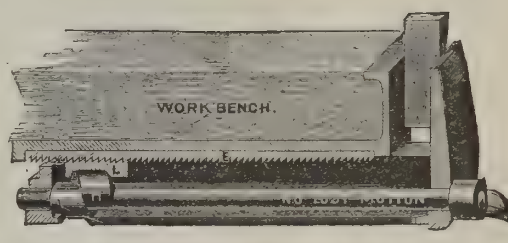
MOORISH FRETWORK.

MASSEY'S PATENT WOODWORKER'S VISE.

It is without doubt the best economy in all workshops, large or small, to admit the use of only the very best qualities of tools in their latest improvements. With some tools the superiority will depend (apart from the questions of durability, simplicity, and so forth) upon the ease and rapidity with which they may be adjusted. In as simple a tool as a vise the saving of a few seconds of time in each adjustment will make in a large shop a very material gain, so that for the reason of economy alone it is obvious how greatly advantageous the use of tools effecting such a saving must be.

Mr. T. C. Massey, of Nos. 11 to 23 South Jefferson Street, Chicago, Ill., and No. 81 John Street, New York City, is the patentee of a form of vise for the use of





MASSEY'S PATENT WOODWORKER'S VISE.

carpenters, cabinet makers, pattern makers, and others, which has the advantage of fastening any size of work instantly by a single motion of the handle. Our engraving shows the vise attached to a bench with flush attachments for wood jaws, and the sectional view clearly illustrates the construction of the vise and the devices for fastening anything between the jaws. E is a long steel rack secured to the under side of the stationary jaw. L is a steel dog which rides on the spiral cam, H, and is formed to engage with the rack, E. H is a spiral cam which raises the dog, L, into engagement with the rack, E, and then draws the loose jaw forward.

In the sectional view the vise is shown under adjustment, with the work firmly fastened between the jaws. To release the work, the handle is raised to a vertical position, when the spiral cam, H, drops the dog, L, out of engagement with the long rack, E, and the loose jaw may then be moved in or out, and can be adjusted at once to any thickness of work within the scope of the vise. A quarter of a turn of the handle is sufficient to firmly fasten the work, all screwing being entirely dispensed with. The work is held in one hand, and the loose jaw is with the other hand pushed against the work; or, where the work is heavy, it may be held with both hands, and the necessary quarter turn of the handle be made with a movement of the body.

The advantages of such a system of construction as that described are considerable. The simplicity and fewness of the parts, the certain grip, which cannot release under the heaviest work, and the very easy adjustment make these vises the best of any in the market, and we have pleasure in calling the attention of our readers to goods of so much excellence.

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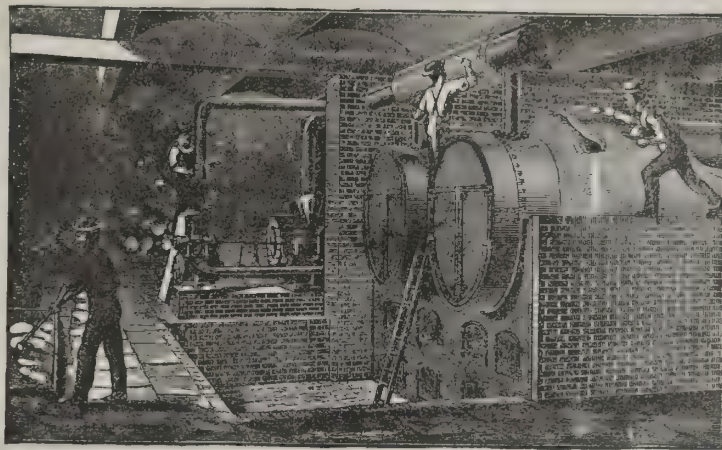

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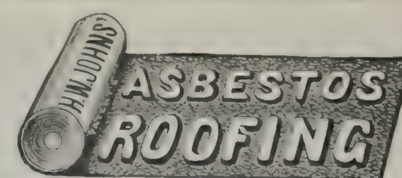

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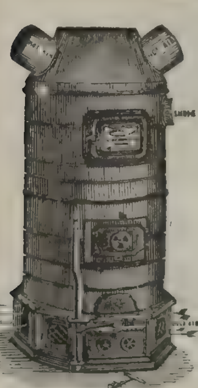

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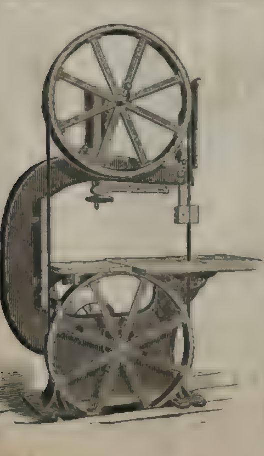

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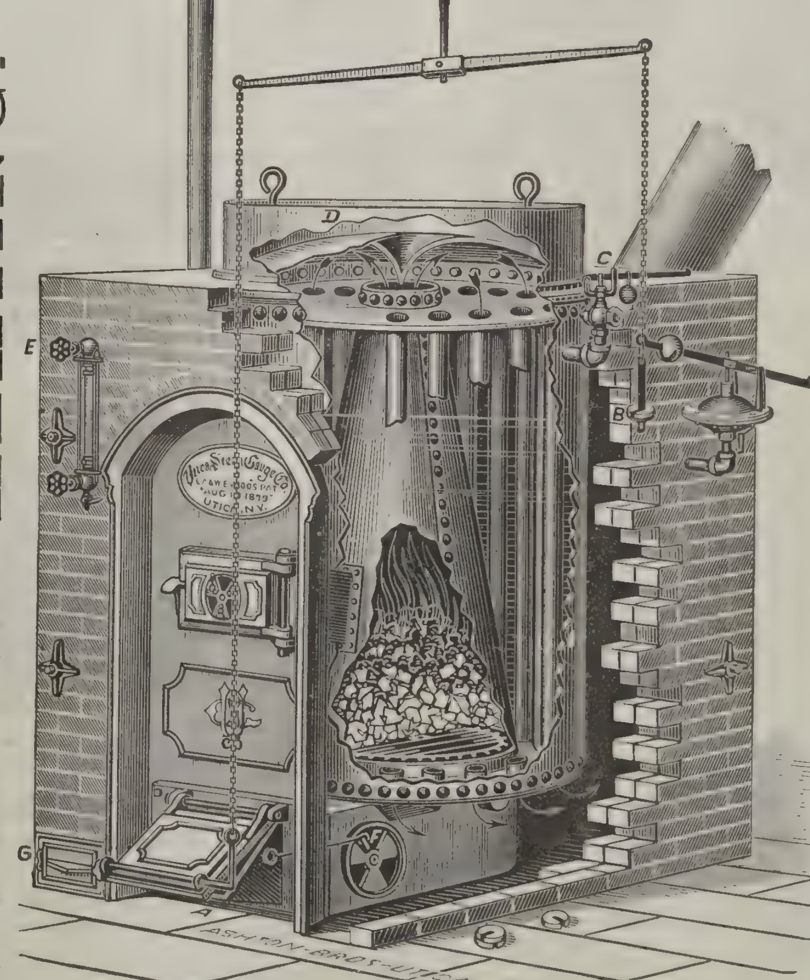

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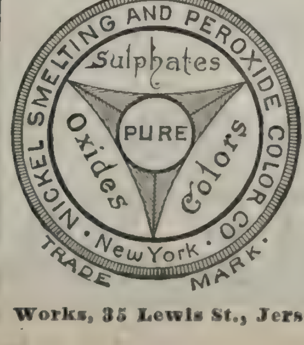

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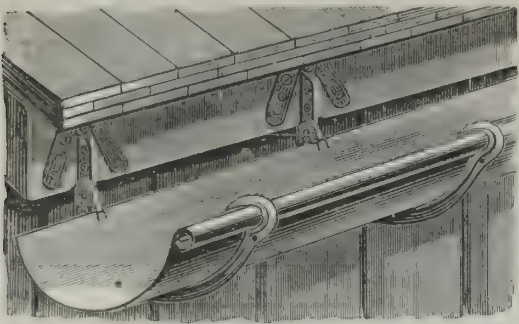

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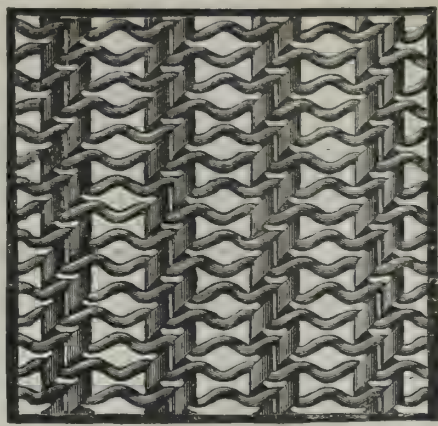

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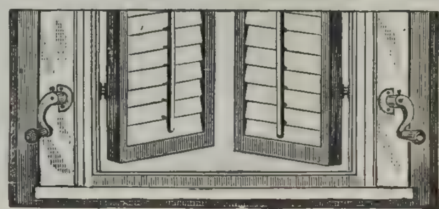

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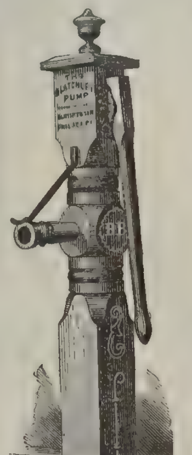

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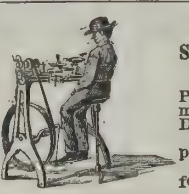

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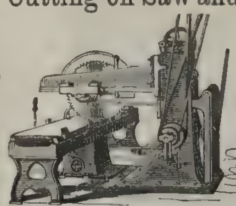

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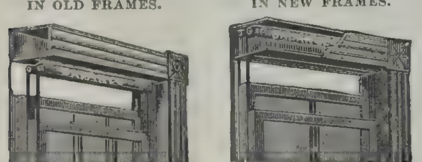

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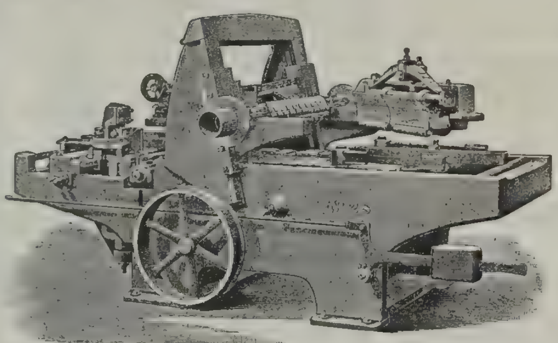

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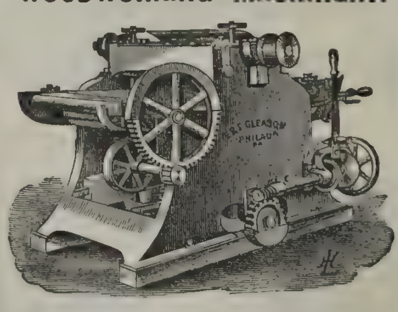

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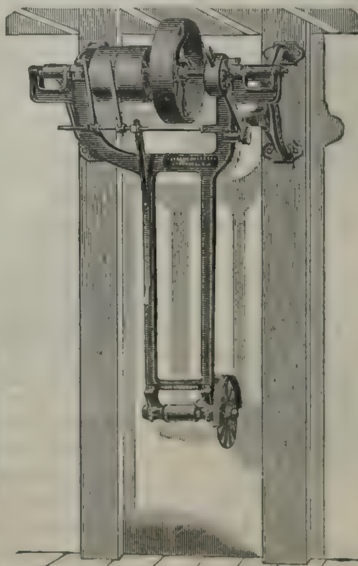

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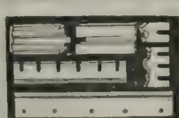

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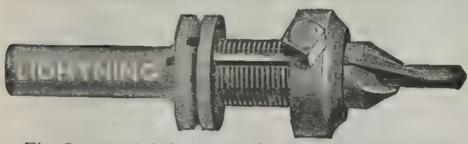

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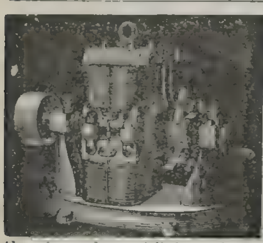

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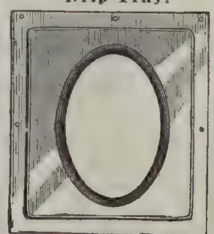

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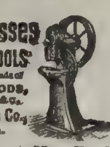

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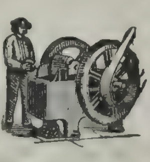

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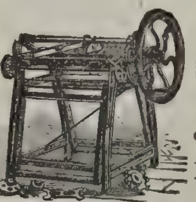

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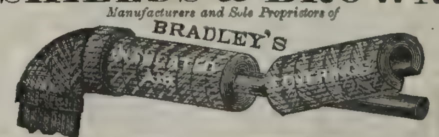

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References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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Minerals sent for examination should be distinctly marked or labeled.

(1) I. B. B.—The white formation appearing on brick walls consists almost wholly of sulphate of magnesia (Epsom salts). See SCIENTIFIC AMERICAN SUPPLEMENT, No. 123.

(2) B. W. B.—You will probably not succeed in obtaining a satisfactory red brick from a clay burning a gray, although you may endeavor to do so by mixing sulphate of iron or iron filings with the clay in tempering. The exact quantity of iron necessary for the purpose will vary with the description of clay and the process of burning, and as no two clays are alike, it can only be determined by experiment.

(3) J. H. asks how to repair concrete chimney tops which become wet through under a continuous rain and leak on the inside. A. If the concrete is quite hard and only cracked, mix Portland cement and sand in equal proportions and carefully fill in; but if it is soft, you can only hope to make a good job by pulling away the rotten portions and reforming them with really good materials. Take care not to expose the cement or concrete to the sun while setting, but keep it constantly damp.

(4) J. A. V. N. says: In the kitchen of my cottage I have a driven well, upon which we depend for all our household purposes. The house is five years old, and closed from November to June. While this water has always been a little impregnated with iron, it has not, in other respects, troubled us till this summer. After standing all night, it is covered with a thick yellow scum, and the water pitchers are so coated with iron that sand is required to remove it. So you can readily imagine what this must be for all laundry purposes; and, notwithstanding a great deal is used during the day, it seems to grow worse instead of better. We have thought it must be from the rust of the pump, which stands idle during the winter. A. Your driven well is probably "black iron pipe," which is always a source of rusty water. At first the black oxide scale on the inside partially protects the iron. When that comes off, there is nothing to prevent the whole surface rusting. There no remedy but to pull the pipe up and drive a galvanized iron pipe in its place, also use a galvanized iron point and strainer.

(5) L. R. G. writes: Will you be good enough to give sufficient directions for the preparation and subsequent treatment of the photographic copying papers giving the following results: White lines on blue ground, blue lines on white ground, and black lines on white ground, on first impression? A. The blue process, giving white lines on blue paper, is described on page 52 of the SCIENTIFIC AMERICAN for July 28, 1883. The revised blue process is as follows: Well sized paper is painted over with a brush with the following solution, freshly prepared: 30 volumes of gum arabic solution (1 to 5), 8 volumes solution of citrate of iron and ammonia (1 to 2), and 5 volumes of iron perchloride (1 to 2). The mixture appears limpid at first, but soon grows thicker. The paper is dried in the dark, then exposed for a few minutes under a negative or drawing, and developed with a solution of 1 part potassium ferrocyanide in 5 parts of water, applied with a brush. It is fixed with dilute hydrochloric acid, 1 to 10, washed thoroughly and dried. For black lines on white ground the paper is immersed in the following solution: 25 ounces gum, 3 ounces sodium chloride, 10 ounces iron perchloride, 45° B., 5 ounces iron sulphate, 4 ounces tartaric acid, and 47 ounces water. The developing bath is a solution of potassium ferricyanide or potassium ferrocyanide, neutral, alkaline, or acid. After being exposed, the positive is dipped in this bath, and the parts which did not receive the light take a dark green color; the other parts do not change. It is then washed with water in order to remove the excess of the cyanide and dipped into a bath containing acetic, hydrochloric, or sulphuric acid, when all the substances which could affect the whiteness of the paper are removed. The lines have now an indigo black color. Wash in water and dry.

(6) G. C. K. desires information as to how to make a cheap filter. A. The mixture of charcoal and gravel is fully equal to anything that can be used for filtering. If you prefer, the gravel can be substituted by spongy iron (metallic iron). See "Experiments with the Silicated Carbon and Spongy Iron Filters," contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 165.

(7) E. L. desires a receipt for making a good stove polish or paste. A. Black lead pulverized, 1 pound; turpentine, 1 gill; water, 1 gill; sugar, 1 ounce; mix.

(8) H. S. S., Jr., asks: 1. Would it be dangerous, in case of lightning, to run a wire cable from the roof of one block across the street to roof of another, both roofs being tin? A. Unless both roofs are well connected with the ground, the lightning striking one roof might be conducted to the other, thence through the house, doing damage. 2. What result do we obtain by mixing a solution of acetate of lead and a solution of sulphate of zinc? A. A precipitate of lead sulphate.

(9) N. K. writes: If you were to put a 2 inch pipe in a 40 foot well, and put a pump on top of the ground, with the valve 40 feet from the water, would the pump work? If not, how high will the water come up in the pipe? A. Twenty-eight to thirty-three feet is the greatest lift for an ordinary pump.

(10) G. L. T. asks: Which is the best floor for roller skating rink—a cement or hard kiln-dried floor? Which wears out the rollers the quickest? A. The hard wood floor. Cement floor disintegrates and becomes dusty, and then is destructive to the rollers also.

(11) J. M. S. writes: In a room for public purposes, 43 feet by 54 feet 6 inches inside measure, the ceiling highest in the middle, but not arched, what would be the acoustic properties when the distance between the floor and highest point of ceiling is 27 feet? A. In parts of the room there will probably be considerable reverberation. The general acoustic properties will depend much upon the location of the speaker, the angles of the ceiling, and continuity of sides or position of rostrum.

(12) S. F. asks how to draw a picture on glass, for magic lanterns; the substances to be used for different colors and the way to use them. A. Very fine pictures may be drawn for the magic lantern with an ordinary lead pencil on ground glass, afterward varnishing the glass to render it transparent. If you desire to make colored pictures for the lantern, you may use any of the transparent tube colors, mixing them with varnish. You will find information on this subject in SUPPLEMENTS, Nos. 423, 173, and 424.

(13) A. G. S. asks whether it is possible to put iridium on edged tools so as to hold the edge for a long time without getting dull; also, if it can be done, the address of any concern that can do it. A. Iridium pointed tools will not do to turn hard steel or even cast iron, as it is too brittle; but for pearl, bone, rubber, or celluloid it has been proved to do ten times the amount of work done with a steel tool before it becomes dull. The iridium pointed tool costs about three times that of a steel tool. The tools are made by the American Iridium Company, of Chicago, of which John Holland is manager.

(14) H. W. T. asks how to construct a dumb waiter or elevator to elevate one or two hods of coal, say 50 pounds, from cellar to next story above, with little exertion of strength. A. These elevators are nothing more in construction than a sort of hung platform or box partly balanced by weights, which most good carpenters understand. We recommend you to consult with some builder in your city. We cannot illustrate it in Notes and Queries.

(15) J. C.—Varnish may be removed by warming and applying methylated spirits or wash, with equal parts of turpentine and spirits of ammonia, then wash with soap suds.

(16) B. S. writes: I have a bunch of small chains entirely coated with rust. I have used coal oil to clear the chains of rust, but to no avail. Could you recommend a better method? A. Shake them in a bag of fine sand or emery.

(17) G. E. W. asks how to build a stone dam, 70 feet long by 10 feet high. A. Dam should be 8 feet wide at bottom, 4 feet at top, sloping back; floor may be made of rough logs under the spill, to break the fall of water. Portland cement is the best, 1 barrel to 3 barrels sand; mix as required in small batches for the best results. We think a wooden trunk the best. Make it square or octagon as convenient. 20 inches diameter, build end into the masonry a few feet, well cemented, and terminate in a stone facing on upper side. Make a coping of large stone sloping back on the spill, and flank with abutments of large stone. Fill in behind the dam with gravel and marl even with top of coping, sloping back at least 30 feet, covering the filling with broken stone.

(18) C. P.—Indian red is made by calcining iron sulphate. It is a more or less pure iron peroxide.

(19) A. E. S.—We can send you "Fur, Fin, and Feather," with game laws of each State, for fifty cents. The following is an excellent harness liquid blacking: Dissolve by heat 4 ounces glue or gelatine and 3 ounces gum arabic in ¾ pint water; add 7 ounces molasses and 5 ounces ivory black in fine powder; gently evaporate over a water bath until of a proper consistence, stirring all the time. Keep in corked bottles.

(20) E. N. asks how to produce cold in a small ice chest without the use of ice. A. Use one of the numerous freezing mixtures, such as equal parts of ammonium nitrate and water; or, eight parts of sodium sulphate with five parts of hydrochloric acid.

(21) E. P. E. asks: 1. What is the glue or liquid used for sticking fringe and plush on card for New Year? A. A good quality of glue dissolved in hot water is generally used. 2. Also the liquid used to gilt the edges of cards. A. A composition consisting of four parts of Armenian bole, and one of candied sugar, ground together with water to a proper consistence, and laid on by a brush with the white of an egg. This coating, when nearly dry, is smoothed by the burnisher. It is then slightly moistened by a sponge dipped in clean water and squeezed in the hand, after which gold leaf is applied. 3. The mixture to bronze gas fixtures? A. Mix vinegar or dilute sulphuric acid (1 acid, 12 water) with powdered black lead in a saucer or open vessel; apply this to the brass with a soft plate brush by gentle brushing. This will soon assume a polish, and is fit for lacquering. The brass must be made slightly warmer than for lacquering only. A little practice will enable the operator to bronze and lacquer with one heating. The color, black or green, varies with the thickness of black lead.

(22) A. O. R. desires a recipe of a compound that would harden wood, so that an article made of maple or any other wood, and in general of a shell-like form, would be capable of enduring considerable rough treatment. A. It has been found that wood acquires a remarkable hardness and toughness when it is placed in tanks and covered with quicklime, which is gradually slaked with water. Wood, such as is used in mines, takes about a week to become thoroughly impregnated.

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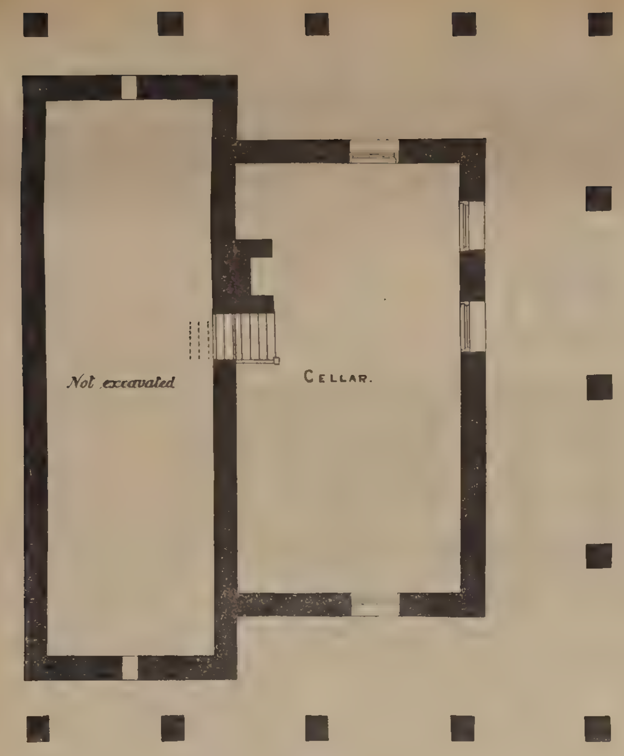
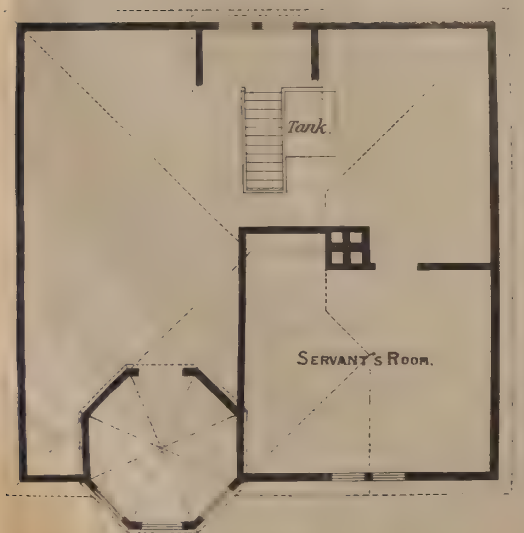
Classified Index of Advertisements Published in the Present Number of the Scientific American, Architects and Builders Edition.

FRONT ELEVATION.



FOUNDATION PLAN.



Details for Cottage at Block Island, R. I.

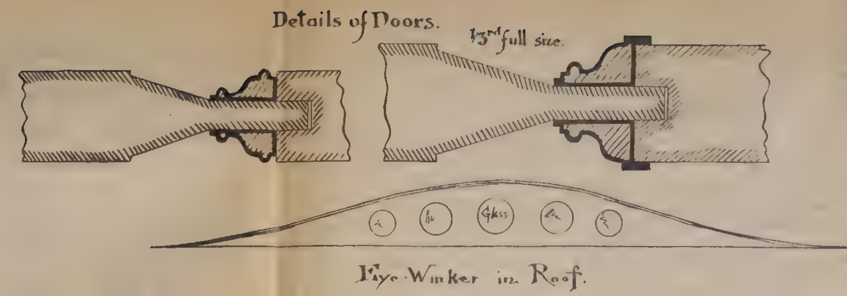
Chas. E. Miller, Architect.

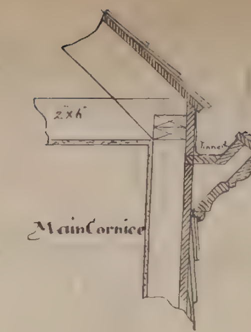
For description see Scientific American Architects and Builders Edition for September, 1886.

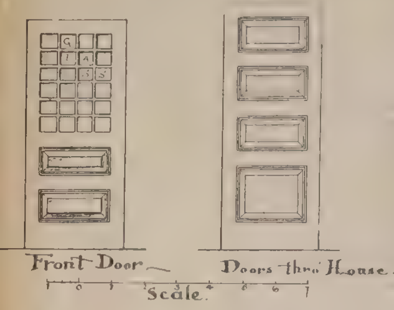
The details at the right of this sheet pertain to the Dwelling at Minneapolis, Minn.

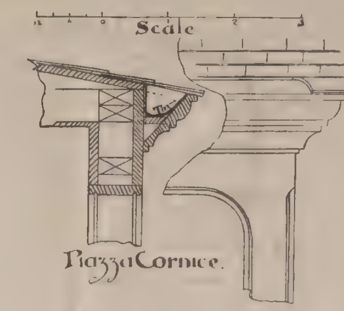
Harry W. Jones, Architect, Minneapolis.

See our Number for November, 1886.

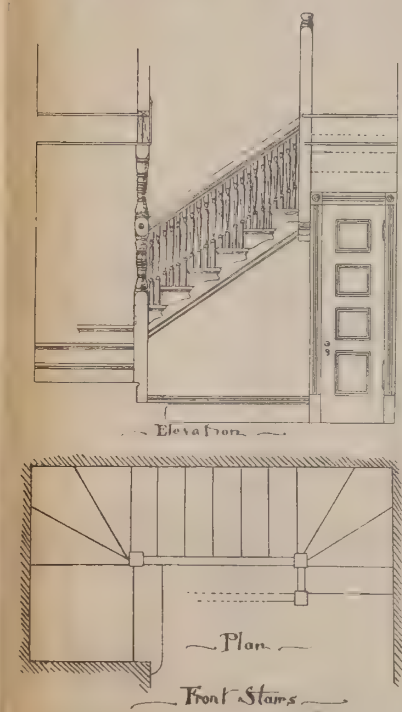


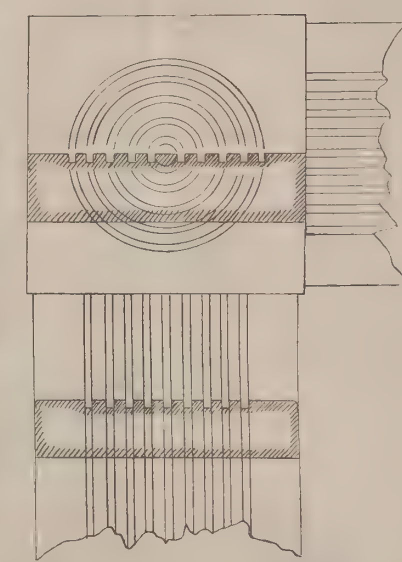




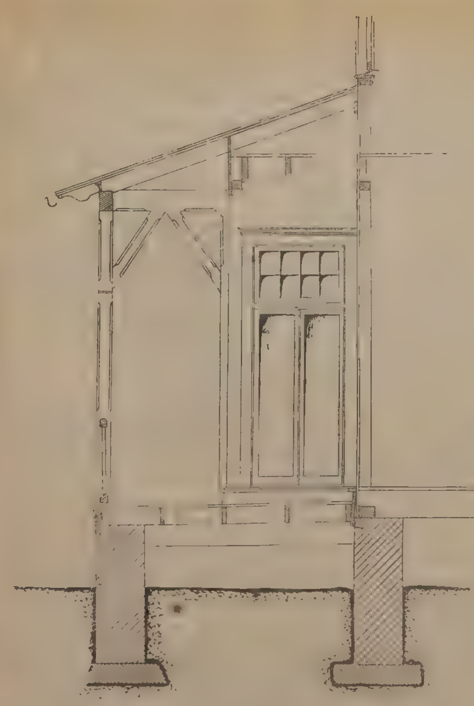


SIDE ELEVATION.





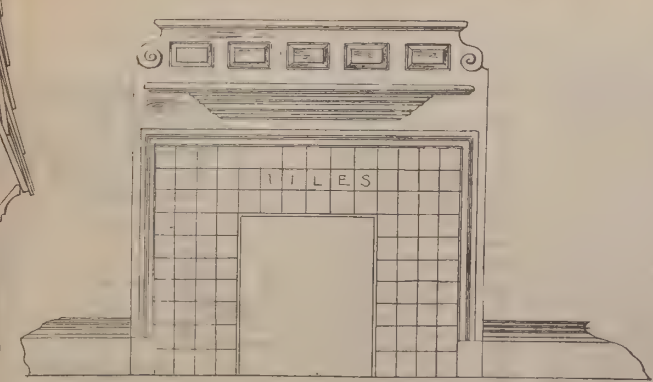
REAR ELEVATION.



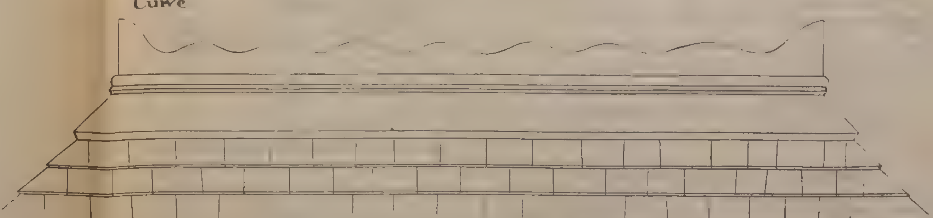
Section through Hall and part of Dining Room.

SIDE ELEVATION.

Belt Course Curve

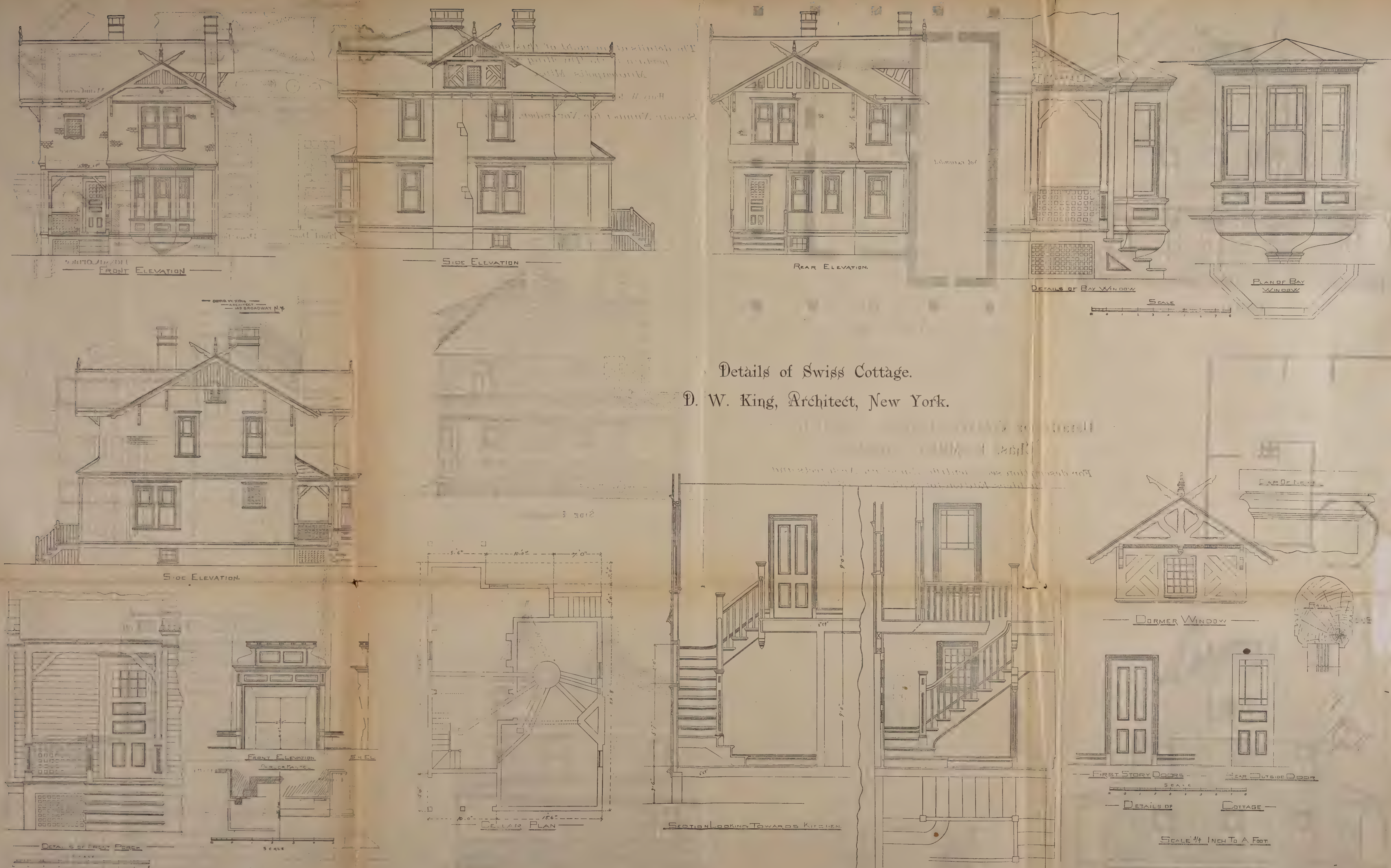


Mantel in Hall



Roof Cresting

Sheet of details to accompany the Architects and Builders Edition of Scientific American for November, 1886.



Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for October, 1886.

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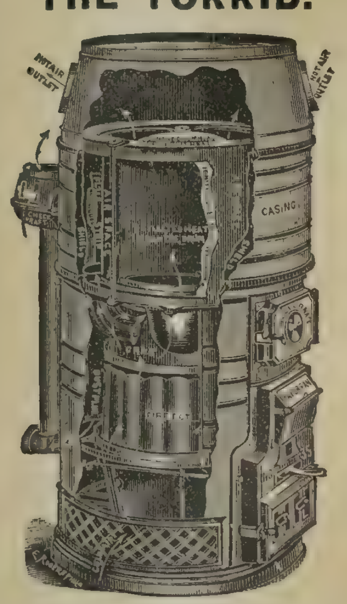

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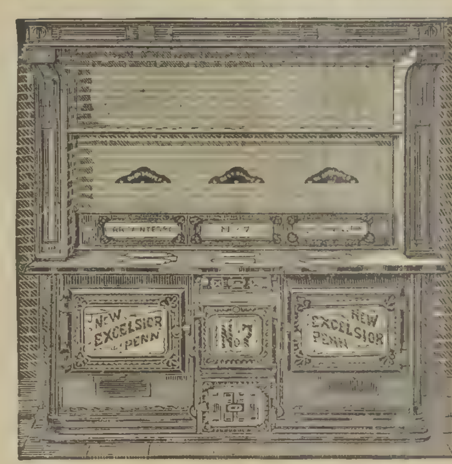

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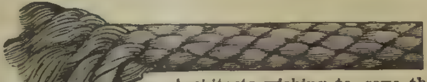

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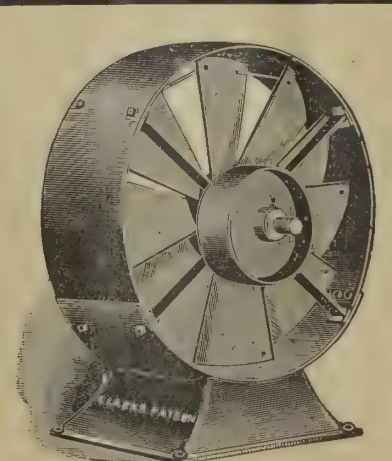

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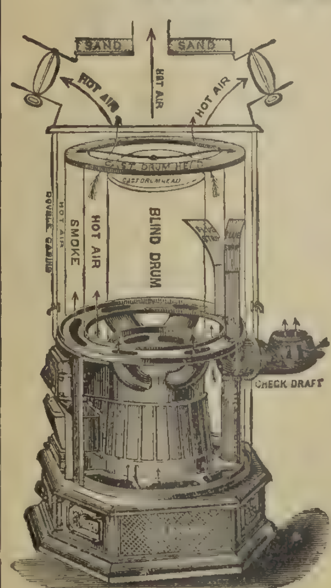

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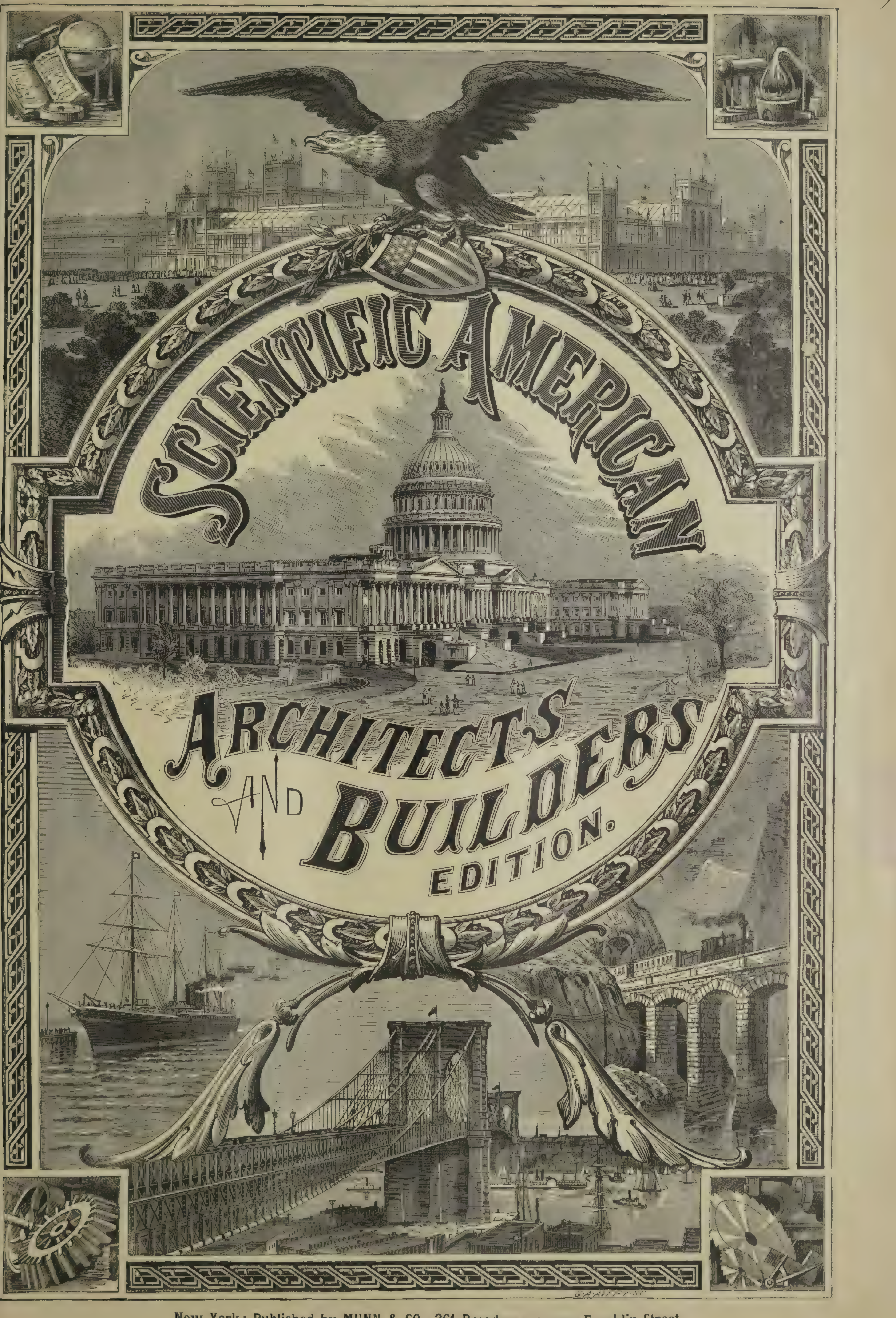

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ARCHITECTS AND BUILDERS EDITION.

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Fig. 1.—THE STATUE OF LIBERTY NEW YORK.—[See page 101.]

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No. 361 BROADWAY, NEW YORK.

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NEW YORK, NOVEMBER, 1886.

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CONTENTS

Of the November number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

A DWELLING AT MINNEAPOLIS, MINN.

One of our colored plates this month represents a very attractive and desirable dwelling, erected not long ago at Minneapolis, Minn., by Harry W. Jones, architect, of that city.

The house is built of wood, *sided* up to the belt course, above which it is *shingled.*

The front hall is finished in red oak, in the colonial style, with dado of red and white checked straw matting; the floors are doubled, and the walls back plastered, and no pains are spared to make the house warm and light in every particular.

The bath-room is directly above the kitchen, and the plumbing is thus concentrated.

A corner sideboard is built into the house, of pine, stained imitation of mahogany.

The total cost was a little less than $2,500.

Our sheet of details for this month illustrates several particulars pertaining to this elegant little dwelling. Any further information desired may be had by addressing the architect, as above.

A VILLAGE CHURCH.

BY F. THORNTON MACAULAY.

The accompanying colored plate has been prepared to show what may be accomplished for a first-class village or town church of moderate capacity, using Romanesque forms and an effective disposition of stone in natural colors. The ground plan and general arrangement are such as commonly pertain to Episcopalian worship. The seating accommodation, including the gallery over the porch, is about 400.

The round arch is adhered to in most of the openings. In the exterior, the arch stones are plain, save that two deeply cut lines, following the contours of the arch, mark off two draughted bands, emphasizing the extrados and soffit respectively. Between these draughted bands the voussoirs display rock face. In the interior, the arch rings are faced with ornamental tiles. The walls of the interior, up to the line of the tie beams of the roof, are faced with tiles, except as otherwise stated or shown in details.

The external walls, everywhere beneath the belt course which marks the gallery floor and clerestory lines, are built of rock face stone. Above this level the walls of the front gable and clerestory are of ashlar, the quoins only being rock faced, with tooled and draughted edges. All archivolts are, as previously stated, rock faced with draughted edges. The joints between voussoirs are marked by rough bevels struck out from the joints.

Internally, the windows and other openings show columns planted in the jambs, and the capitals and bases of these are united and strongly accentuated by horizontal bands of worked stone or terra cotta. Externally, no columns are thus shown in the aisle and clerestory windows and analogous openings; but belt courses similar to the bands just mentioned are used to connect the openings in composition. The great windows of the front gable, and all of the tower openings above the first floor line, show columns embedded in the jambs, each with its own base and capital. The belfry windows are separated by clustered columns, each cluster possessing a capital and a base connected with the others by belt courses.

The horizontal courses are everywhere used to emphasize the structural members of the composition. In the front gable the lines of the ties, sills, and gallery floor are thus united, and horizontal bands also bind the gable to the tower, and express the different landings in the tower.

A broad band carries the decorative *motif* of the porch capitals all about the tower and its buttresses, and this is joined, at the beginning of the nave wall, with a rough decorative band, which fills the spandrels of the aisle windows, and embraces also the semicircular projections of the transepts (to strain a term) and the sanctuary wall between them.

The finest sculptural work of the exterior is concentrated in the apex of the front gable. The spandrel course of the aisle walls, besides the color effects later described, is decorated by the frequent insertion, at random, of large stones bearing strongly chiseled reliefs of the simplest design. The character of the cuttings in capitals, cornices, and other members so decorated, is to be bold and sharp in outline and mass.

The scheme of color for the exterior contrasts a lower story of dark bluestone with a wall of deep reddish-yellow granite in the gables and clerestory, neither color being quite homogeneous, but rather mottled and generous of weather stains. The arch rings, belt courses, quoins, and cornices are in red sandstone or Longmeadow stone. The spandrel course of the aisle walls presents, as to color, a rough mosaic of stones, showing not only the chief colors of the main walls, but also blocks of gray and green. The story of the tower immediately under the belfry is faced with tiles in dull reds, browns, yellows, and greens. The main roofs are crested with tiles, and all roofs are covered with red slate.

The interior of the church is floored with pine stained a dark reddish brown. The tiled walls give successively lighter effects of the same tone, the highest pitch of the color being reached in the roof. The aisle walls are tiled up to the sill courses. The aisle and clerestory walls show, between the cap and base courses, same stone as in the exterior. The spandrels of the nave arches are tiled, and those of the aisle and clerestory are coated with moulded plaster. The latter serves to break the other tones of color by two surfaces of delicate gage green, the darker of which fills the spandrels of the aisle. The plaster surface is to be touched lightly with gold in a spiral pattern. The walls of the sanctuary continue the effects of the nave. The roof, which is in the form of a triplicate barrel vault in simple matched pine and open timbered trusses, is stained in a lighter tone of red-brown. The panels are accentuated at the crossings of the framing by copper bosses.

Breaks in the general tones of color are afforded by the stained glass windows, by the voussoirs of the arches in red terra cotta, and by the columns in red-dish-yellow granite.

The church is to be built in the best manner and with the best materials. The basement gives accommodation for Sunday schools, and is well lighted by windows of varying heights as permitted by the ramping ground lines of the side elevations. Heating apparatus in cellar beneath transept. Ventilation amply provided for, elements in this system being the tower, the main roof "winkers," and the rows of decorative openings in the fascia of the cusp of the nave vaults. Estimated cost, $40,000.

OUR SHEET OF DETAILS FOR NOVEMBER.

Our sheet for this month contains illustrations of details relating to three buildings, namely, the sea-side cottage of which we gave a colored plate in our September number; the Swiss cottage of which we published a colored plate in our October number; and a dwelling at Minneapolis, of which a colored plate accompanies this present November number.

HOW TO HAVE A DRY CELLAR.

A dry cellar is of the utmost importance to every house. Yet it is safe to say that many, if not most, of the houses built for $5,000 or less in our suburban towns are faulty in this respect. It is generally assumed that water will not get into the cellar *after* the superstructure is built, and therefore no means to prevent it are taken. To accomplish this desired end, the best way is to make the excavation say 4 inches *larger* than the foundation wall requires, and as the wall is laid up, carefully plaster the outside of the wall with the best Portland cement, composed of one part cement and two parts of sand. It is advisable also to use cement liberally in the mortar. The surface water, after heavy or protracted rains, soaks downward through the ground, and penetrates the walls as ordinarily constructed. If, however, above precautions are taken, the water will find its way down behind the walls to the trench under it, which, being filled with 12 inches of small stones, will act as a blind drain; and if the inclination of this drain is (as it ought to be) toward one corner of the cellar, the water will be carried to this one point, from which there should be a 4 inch drain of tiles leading to the surface of the ground on a lower level. To this outlet there should also be a drain from the excavation under the furnace. These precautions will insure a *dry cellar* without much additional expense if done at the right time, that is at the beginning of and as the work progresses. The surface of the ground immediately around the house should slope considerably away from the foundation wall for the distance of at least 15 feet, instead of being almost, if not quite, level, as is so often the case. Water naturally always runs down hill, and seeks a lower level with the greatest persistency, therefore it is always trying to get into the cellar, and it will surely get there if efforts are not made to keep it out when it reaches the wall, or to cause it to run away *from* the house on the surface, by a proper grading of the ground.

Ancient Japanese Castings.

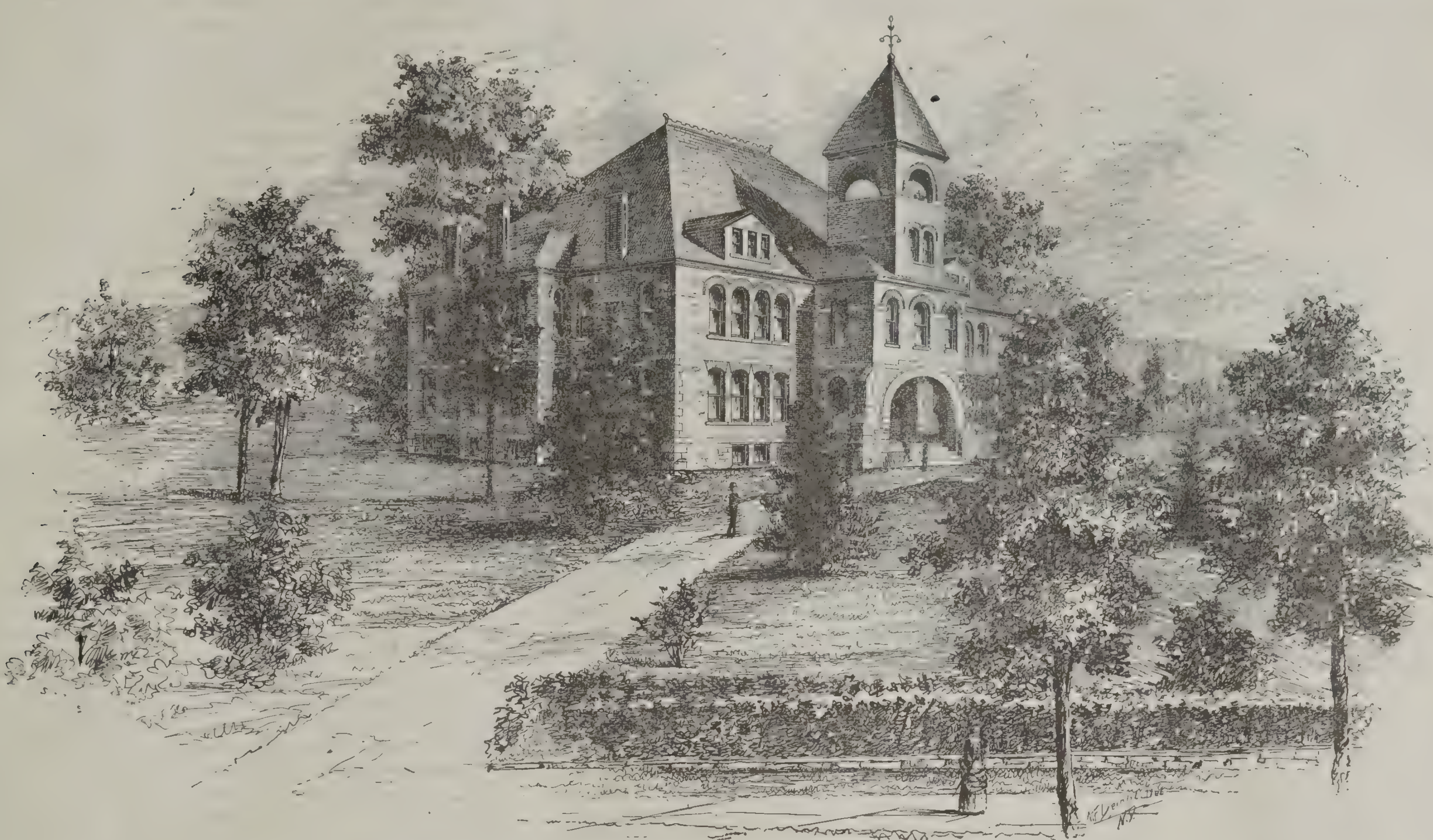
Two of the largest castings in the world are to be seen at Nara and Kamakura, Japan, the one at the latter place being 47 feet high, and the other, at Nara, 53¾ feet from the base to the crown of its head. The statue at Nara is supposed to have been erected in the eighth century, but it was destroyed and recast about 700 years since. In endeavoring to recast it, several mishaps occurred, and when at last success came, some few thousand tons of charcoal had been used. The casting, which is an alloy of iron, gold, tin, and copper, is estimated to weigh 450 tons.

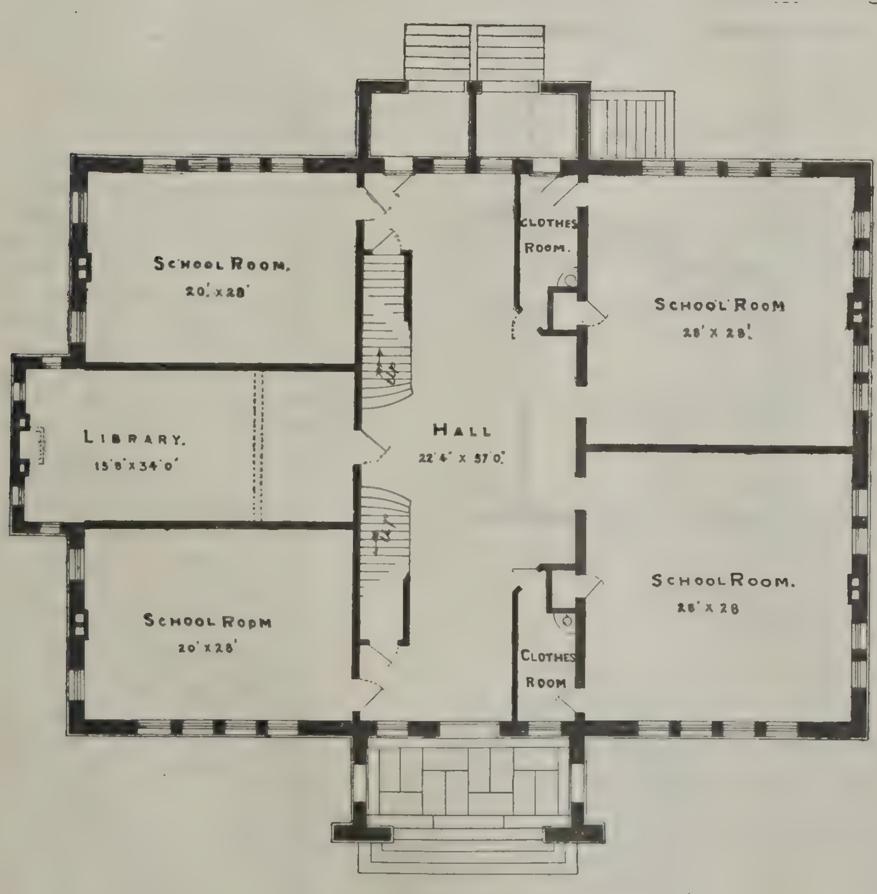
THE condensation of steam in the pipes of the New York Steam Company is only about 10 per cent, while the loss in pressure in ⅝ of a mile of pipes, maintained at 75 to 80 pounds, is only about 2 to 2½ pounds. The company sells steam by the "kal," a kal being one pound of water evaporated under a pressure of 70 pounds, from a temperature of 100 degrees Fahr.

THE NEW ACADEMY, MONSON, MASS.

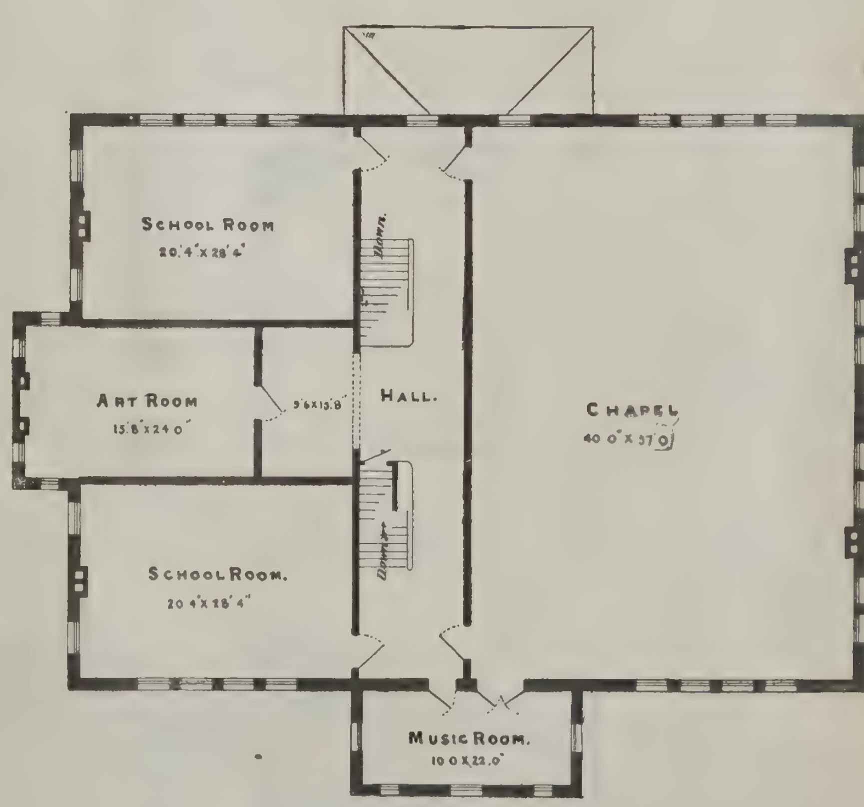
Our engraving illustrates this new educational building, now nearly completed, for the time-honored institution of learning known as Monson Academy, in the thriving town of the same name, Hampden County, Mass. For the successful erection of this edifice, the chief credit is due to Mr. Wm. N. Flynt, of Monson, whose exertions in securing the necessary subscriptions, and initiating the work of rebuilding have been most generous and unremitting.

The dimensions of the building are 83 by 60 feet, and will seat 56 pupils, while the north rooms are 20 by 28 feet, to seat 42 pupils. The library, between the latter rooms, is 16 by 34 feet. In the south end of the second story is the chapel, 40 by 57 feet, and 20 feet in height, seating 300 persons. In the north end are two school-rooms, 20 by 28 feet, seating 42 pupils, and the reception-room between them is 11 by 57 feet. There is also a small music-room over the front porch, 10 by 22. All the rooms and halls in both stories will be wainscoted four feet high. The halls and the library are to be finished in ash, but the school-rooms in the





First Floor Plan.



Second Floor Plan.

THE NEW ACADEMY, MONSON, MASS.—E. P. BALL, ARCHITECT, PALMER, MASS.

The front porch is 11 by 24 feet, and the rear one 8 by 24. The clear height of the basement and of the first and second stories is 11 feet. The underpinning is 4 feet high, and is pointed in broken ashlar of granite, capped with a water-table of the same stone, and the superstructure is to be of brick laid in red mortar. All the corners of the first story have granite groins, with buttresses on the front porch. The hip-roof is slated with a terra cotta cresting. The tower projects two stories above the main building, and also has a hip roof slated and capped with copper finial. All the trimmings are rock-faced Monson granite. In the basement is to be the laboratory, 20 by 28 feet, fitted with modern apparatus. On the first floor is the main hall, 22 by 57 feet, on both sides of which are school-rooms. Those on the south side are 28 feet square, first story will be finished in whitewood; in the second, in North Caroline pine, with white pine trimmings. The ceiling of the chapel is sheathed with whitewood in panels, and has white pine mouldings. Fireplaces of pressed brick, with wooden mantelpieces, find place in the reception-room and library. All the interior woodwork will be finished in the natural color, and both stories will have hard-wood maple floors. The building is piped for gas, and will be heated by steam with the system of direct radiation. The builders are the Flynt Building and Construction Company, of Palmer, and the architect, E. P. Ball, of the same place. The cost is estimated at $3[illegible],000.

Monson Academy was incorporated in 1804. Hundreds of her graduates occupy prominent positions in the professional and mercantile ranks of the country.

Preservation of Wood.

Prof. Dr. Meidinger states that Prof. Poleck has discovered that timber procured for him purporting to be winter-felled wood was in reality raft timber floated down the river, and he has ascertained that timber which has been thus immersed is no longer liable to the attack of dry rot. So much so is this the case, that in Alsace it is customary to specify that only raft timber shall be employed. The water slowly dissolves out the albumen and salts, and thus deprives the fungus of the nutriment needful for its development. A French savant has found by experiment that whereas fresh sawdust, when buried in damp earth, rots away in a few years, sawdust which has been soaked for some time in water, and has been thereby deprived of soluble matters, will remain in the ground under similar circumstances wholly unchanged, and only slightly tinged on the exterior with earthy matters dissolved from the soil.

AN adjustable scaffold has been patented by Mr. Samuel Tucker, of Pleasanton, Kan. It is a construction for the use of carpenters, masons, etc., so designed as to be easily adjustable as to height as the work progresses, by means of a windlass located upon the scaffold within reach of the mechanic, while the device is durable and not expensive.

DESIGN FOR A ONE THOUSAND DOLLAR COTTAGE.

Annexed we give drawings of a small laborer's cottage designed by Mr. Charles E. Miller, architect, of 149 Broadway, New York city, together with specification and estimate. The floor is arranged one foot above the ground. The elevation is attractive, and would form a pleasing feature on the landscape. The designer has made the most of the limited space at his command, and has provided a good parlor and kitchen, with three bedrooms.

The following is the specification:

GENERAL CONDITIONS.

The contractor is to furnish all transportation, labor, materials, and apparatus needful for performing the work in a perfect and substantial manner, and is to obtain all permits. The plans and specifications are intended to be co-operative; and if anything should be shown on the plans and not mentioned in the specification, or *vice versa*, the same is to be finished as though it were both shown and specified.

MASON.

Excavation. — Excavate for foundation wall 3 ft. below general grade, and place earth where directed.

Foundation Walls.—Build up walls from bottom of trench to height above grade as shown on elevation. Walls to be 1 ft. 6 in. thick, of good building stone, laid in lime and cement mortar, with proper proportions of clean, sharp sand.

Brickwork.—Build chimney as shown, of hard, well-burned brick, laid in lime and cement mortar.

Hearths of bluestone or slate, of sizes shown.

Cesspool.—Build of stone a circular cesspool 4 ft. in diameter, drawn in at top and covered with flag.

Lath and Plaster.—Laths of spruce free from imperfections. Plaster to consist of two coat work, brown and skim. Lime to be good Rockland lime, clean, sharp sand, and best cattle or long goat hair.

CARPENTER.

Scantlings.—Sills, 4 in.×4 in.; plates, 4 in.×4 in.; posts, 4 in.×4 in.; girts, 4 in.×4 in.; floor beams, 2 in.×8 in.; first tier, 20 in. on centers; second tier, 16 in. on centers; studding, 2 in.×4 in.; all to be of hemlock. Beams to be cross bridged.

Frame to be well put together, braced, and plumbed; do all necessary framing for hearths, etc.

Sheathing.—Cover frame with hemlock sheathing boards, and over same tack good sheathing paper.

Siding.—The siding where shown to be of well seasoned stuff.

Shingles.—Cover roof and sides where shown with good sawn pine shingles.

Window Frames.—As shown, to be sliding. Sashes ⅝ in. thickness, and of number of lights shown.

Glazing.—Glass to be single thick American, well puttied, etc.

Gutters.—To be galvanized hanging gutters. Leaders 3 in. galvanized iron.

Inside Stock.—Flooring of merchantable spruce, 4 in. wide. The whole of trim, doors, etc., to be of stock patterns of local manufacture; all doors to be four paneled. Stairs to be built as shown with 1¼ in. thick treads, ⅞ in. risers, housed into wall strings, the staircase inclosed with ⅞ in. tongued and grooved spruce boards, 4 in. wide. Fit up around sink with same stuff.

PAINTING.

The painting inside and out to be done with best white lead and linseed oil, finished in colors selected. All to be two coat work.

HARDWARE.

Locks to be cast iron rim locks, with porcelain handles. Closets to be fitted up with one row of cast iron double hooks, 8 in. apart. Front door to have gong, with necessary wires, etc., and porcelain bell pull.

PLUMBING.

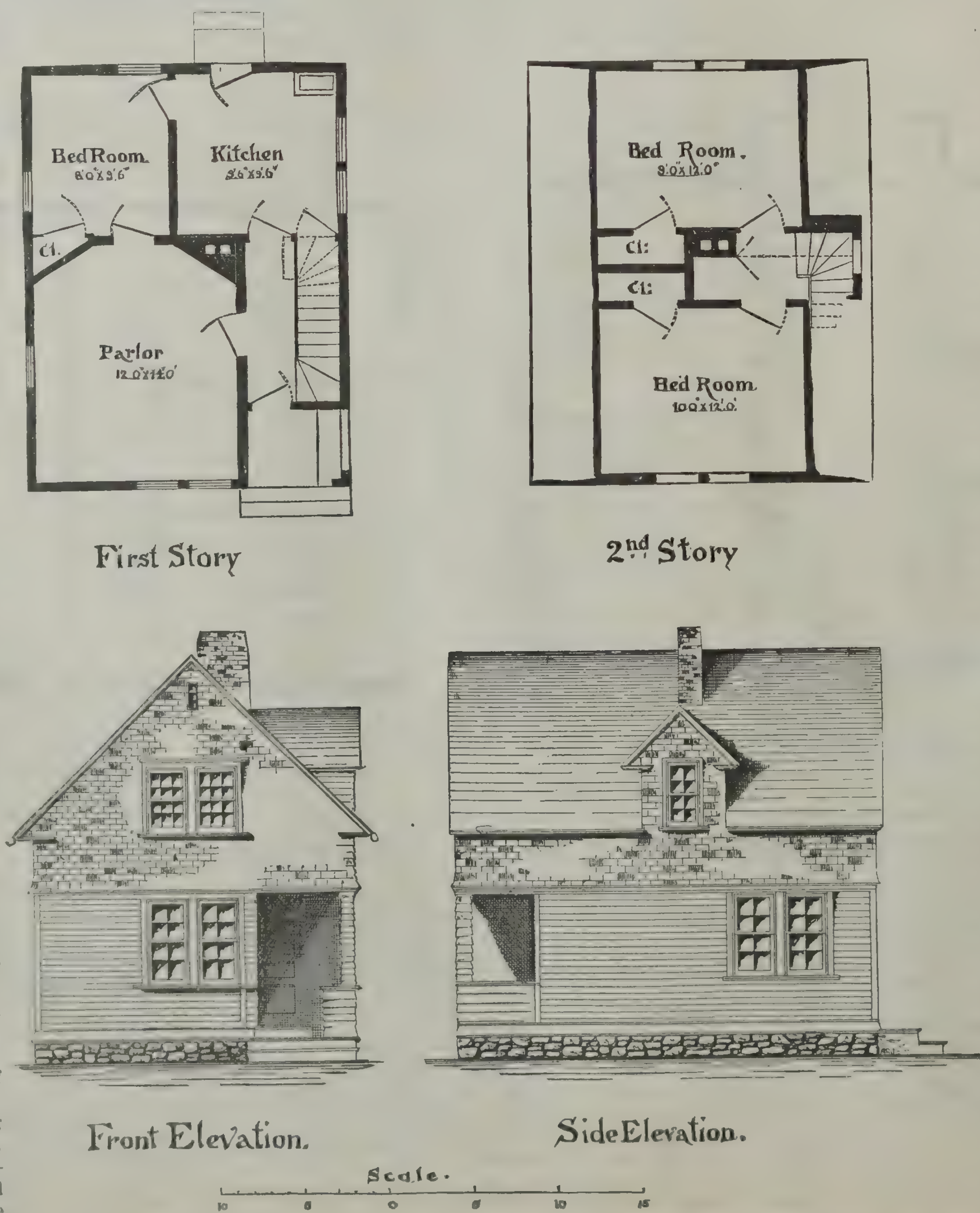
Finish and fit up sink of plain cast iron, 2 ft. by 3 ft., supplied with common lifting pump, wasting through 2 in. lead S trap. This to be calked into iron pipe, which will connect with earthenware drain to cesspool (drain pipes to be furnished by owner). Plumber to make a connection with pump. Pipe to be A pipe ¾ in., to run outside of building, and connect with pipe to well.

ESTIMATE.

Mr. Charles E. Miller:

Dear Sir: We propose to build your house, according to above specification and plans, for the sum of nine hundred and eighty dollars.

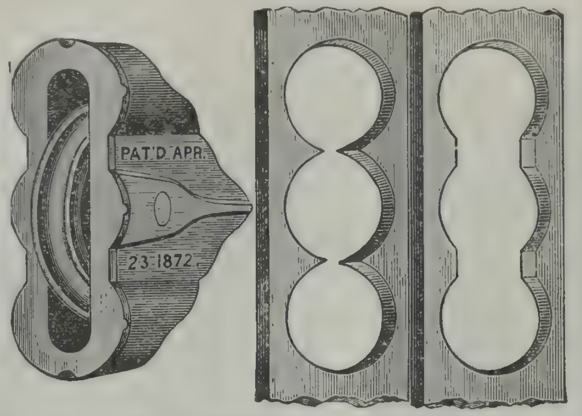
(Signed) Chamberlain & Richardson.



DESIGN FOR A COTTAGE COSTING ONE THOUSAND DOLLARS.

THE VICTOR FRAME PULLEY.

Messrs. Peabody & Parks, of Troy, N. Y., are now manufacturing the new description of frame pulley



THE VICTOR FRAME PULLEY.

illustrated in the sketch. The form is an improvement upon that for which a patent was granted in 1872, and new patents are pending to cover the whole pulley as now manufactured.

The pulley is of the class which are fixed in the window frame without screws or fastenings, and is specially designed for thin sashes where narrow mortises are necessary. In fixing, three holes are bored through the window jamb with a bit, and the pulley is then driven home with a hammer, and, being provided with chisel-shaped edges, it readily cuts away the projecting corners between the bit holes, and so practically cuts its own mortise. A small face plate adds to the appearance of the pulley, and it is provided on its edge with three small projecting spurs, with which to mark the centers of the bit holes.

The saving of time by the use of these pulleys is considerable, and it is claimed that there is no danger of splitting the frames, and that the pulleys are held quite firmly in position.

They are made in 1¾ in., 2 in., 2¼ in.; and 2½ in. sizes, and are supplied at moderate prices.

Terra Cotta vs. Stone.

A deputation from the trade society of Birmingham stone masons recently waited upon the mayor of that town for the purpose of representing certain facts having reference to the proposed use of terra cotta in the new Assize Courts. The deputation consisted of Mr. H. Keyse, chairman of the society, and Mr. J. Farr, secretary. The deputation urged that terra cotta had been spoken of to the General Purposes Committee of the Town Council in such a way as to damage the interests of the stone masons' trade. Stone was stronger in every way, more durable, and able to "carry a better line"—that was to say, to preserve the integrity of its position in a building. As evidence of the weakness of terra cotta, they referred the mayor to the archway of the new Liberal Club, which was already cracked, and in which the lines of the fluting were no longer parallel, and to several other examples. They represented, moreover, that if terra cotta were the medium used for the Assize Courts, a sum of between £20,000 and £30,000 would be spent outside the town, which might go to benefit its inhabitants; and they were anxious to ascertain if it had been definitely decided to use terra cotta.

The mayor, in reply, said he believed that the contracts had not been given out, but he could not say if the matter was open now to reconsideration. He would, however, convey to the proper persons the representations which had been made to him.

Mr. Jethro A. Cossins, of Birmingham, writes: "As architect of the Liberal Club, will you permit me to say there are no signs of any failure of the minutest kind in the terra cotta used in that building, and that I have perfect confidence in its ability to resist the great pressure to which it is in some parts subjected, and to defy the acid-laden atmosphere of this or any other town. The deputation from the masons were singularly unfortunate in their search for facts on which to base their demonstration of the inferiority of terra cotta, as there is not the slightest sign of crushing or splitting in the building which the masons seemed to have examined so anxiously in the hope of finding it. The small crack visible in one of the blocks of the arch over the doorway of the club is only a fire crack, the result of the enormous heat to which it has been subjected, and does not indicate any weakness in the block whatever. As to its yielding to the load above it, that is quite out of the question, as it has little more to do than carry its own weight, there being no superstructure to the porch. Now the arches of the Arcade in Edmund Street each carry more than 120 tons, and this without the least sign of giving; but even if a slight sign of yielding to pressure could have been found, it would be no more than can be seen in very many of the stone buildings of the town, and would, therefore, go for nothing. I know, and everybody else knows, that the same accuracy of lines that may be attained in stone cannot be expected in terra cotta. But this difficulty should be remembered in designing the building, and the details should be adapted to the capabilities of the material. These slight defects would then become of secondary importance. It seems to be a pretty general opinion that in our climate—cold, gray, and murky for nine months out of the year—the color of terra cotta is extremely bright and agreeable.

The decayed branches of old trees should be promptly removed. Their unsightliness is the least of their evils.

THE EAST AVENUE PRESBYTERIAN CHURCH, SCHENECTADY, N. Y.

We give herewith illustrations of this new edifice, lately erected in Schenectady, N. Y. The floor plan we give in colors on another sheet; and in a future number we hope to present a colored plate of the entire building, which is very ornamental. For the following particulars we are indebted to the *Albany Argus*. The architect in Mr. James Lyman Faxon, of Boston, Mass.

The style of architecture is the type known as early Romanesque. The materials to be used for the exterior are local limestone in the rock face, trimmed with Croton front bricks in the arches, quoins and jambs to doors and windows and belt courses, the water table, steps, window sills, keystones, skew backs, kneelers, copings, and saddle blocks being of limestone from the quarries at Palatine Bridge.

The external walls are 20 in. thick. The foundation walls are 28 in. thick at the top and 32 in. thick at the bottom, and rest on bedstones 44 in. wide. The foundation to the tower is 36 in. thick at the top, 44 in. thick at the bottom, and rests on bedstones 60 in. wide. The foundations to the piers which carry the great arches, which are the feature of the interior, are 6 ft. square. All foundations are laid in cement mortar.

A glance at these foundations will convince any one of the thorough provisions the architect has made in this respect, and it is the one thing this architect is most particular about in all his buildings.

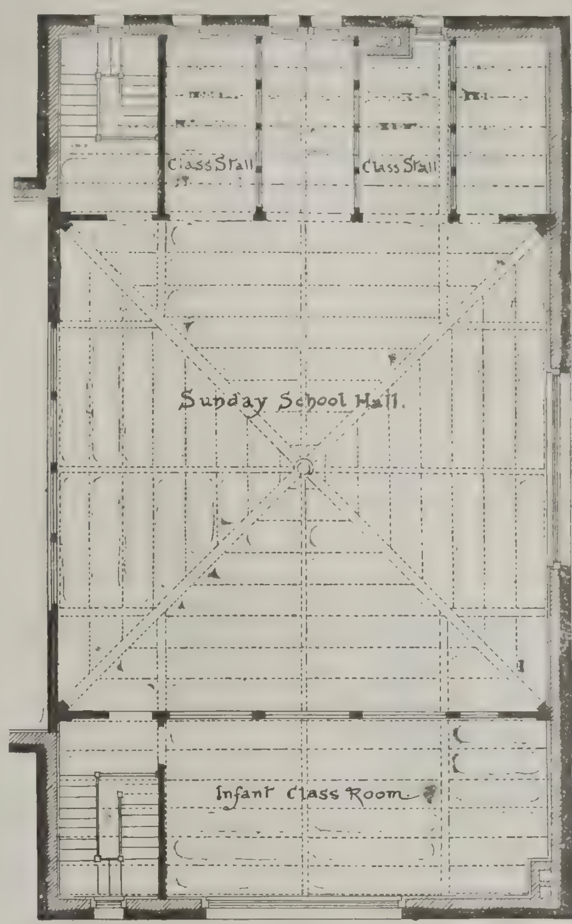
The extreme width of the structure is 96 ft., and the extreme length is 132 ft. The height of ridge is 42 ft. above grade. The tower is 14 ft. square at the base, and 88 ft. high, 75 ft. being of stonework. The roofs are slated with black slates with copper flashings.

The tower is located at the southeast corner and batters from grade to the top, finishing with heavy corbeling of brick, surmounted with a pyramid, which is roof slated. The belfry story is marked by four (long) high arched openings, and four stone waterspouts discharging the water from the bell deck.

A notable feature of the design is the three semi-octagonal bays, or apses, forming the East Avenue elevations; the central one, the largest, containing the chancel, the one to the left the pastor's study, and the one to the right, adjoining the tower, the organ chamber. Entrance to the main auditorium is had through semicircular vestibules opening into the east and west transepts; also from the arched loggias located between the transepts and the chapel part of the building—entrances to the chapel being through the same loggias.

The intradoses of the external arches are turned with a large bead-moulded brick.

The interior of the church will be built and appointed thus: The shape of the auditorium is a Greek cross,



Plan of Sunday School Floor.

the nave running nearly north and south and the transepts east and west; the chancel being at the southerly end, and the chapel opposite or at the northerly end. The largest axis of the chapel runs east and west, or at right angles to that of the church. The auditorium will present a fine effect; the crossing of nave and transepts is marked by immense arches of pressed and moulded bricks, the arches being of 40 ft. span and 26 ft. from floor to intrados of arch at crown.

Similar arches separate the chancel, organ chamber, and pastor's study from the main body of the church and open each into the other, those to the organ chamber and pastor's study being filled with ornamental screens of cherry backed with stained glass. These arches spring from large clustered piers of brick ornamented with terra cotta caps and bases. The opening between church and chapel is a large arch, twenty-four feet span, corresponding with the chancel arch opposite. A wainscoting of pressed and moulded bricks corresponding with the arches, with terra cotta cap and base, skirts the auditorium, chancel, pastor's study, and vestibules.

The finish of the roof will be open-timber construction and sheathing—the sheathing being laid diagonally between the rafters. The rafters are all moulded, and the trusses at the crossing of nave and transepts and in the chancel will show a fine piece of ornamental construction. The rostrum front, chancel steps, and speaker's desk are of cherry, paneled. The framing of the roofs and trusses is of Norway pine, and the sheathing of whitewood. The timbering will be stained a rich cherry, and the sheathing finished in the natural color. The pews will be of whitewood of an appropriate design, corresponding with the general architecture. The windows for the present will be glazed with ribbed glass, this being the outside glazing. Ultimately, they will be filled on the inside with rich stained glass of Romanesque design by the architect.

The chapel building contains, in the first story, a chapel room 30×40 feet, Bible class room, library, ladies' parlor, toilet closets, and kitchens, the chapel opening by folding doors and sashes into the main auditorium.

The second story contains a Sunday school hall 40×40 feet, infant class room and class stalls adjoining and opening into Sunday school hall. Spacious entries and staircases give ample access to all apartments and ample means of exit.

The mason is J. Van Zandt, of Schenectady, N. Y.; the carpenter, John Cuerden, Jr., Ballston; J. L. & A. B. Frey, of Palatine Bridge, N. Y., furnish the cut stonework.

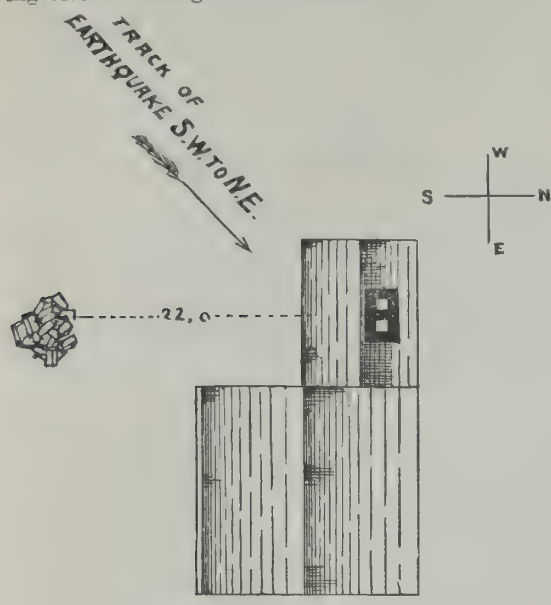
The Glens Falls Brick and Terra Cotta Company furnish the face and moulded bricks and terra cotta for the interior dressings. The general style and plans are quite unlike any other similar edifice in this neighborhood. The style of architecture is in the same class as that followed by the late Mr. H. H. Richardson. The architect is a specialist in acoustics, and the church is planned and designed on the laws of that science.

THE EAST AVENUE PRESBYTERIAN CHURCH, SCHENECTADY, N. Y.—JAMES LYMAN FAXON, ARCHITECT.

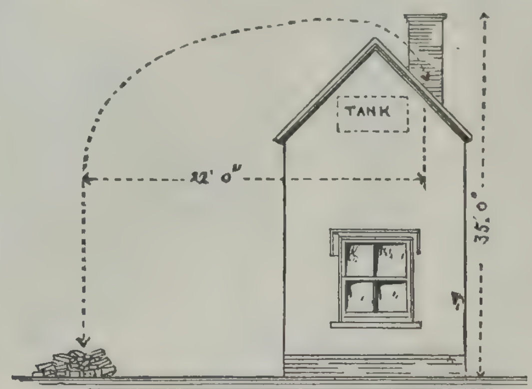
THE EARTHQUAKE AT CHARLESTON.

To the Editor of the Scientific American:

I would like to have your opinion as to the rise and fall of the earth. At the time of the recent earthquake here, our dwelling house was rocked by the wave of the most severe force, which caused three neighboring brick buildings to be wrecked.



Plan



The bricks were found in one pile all loose on the ground; very small number of bricks were found on lot north side of house.

Elevation.

THE EARTHQUAKE AT CHARLESTON.

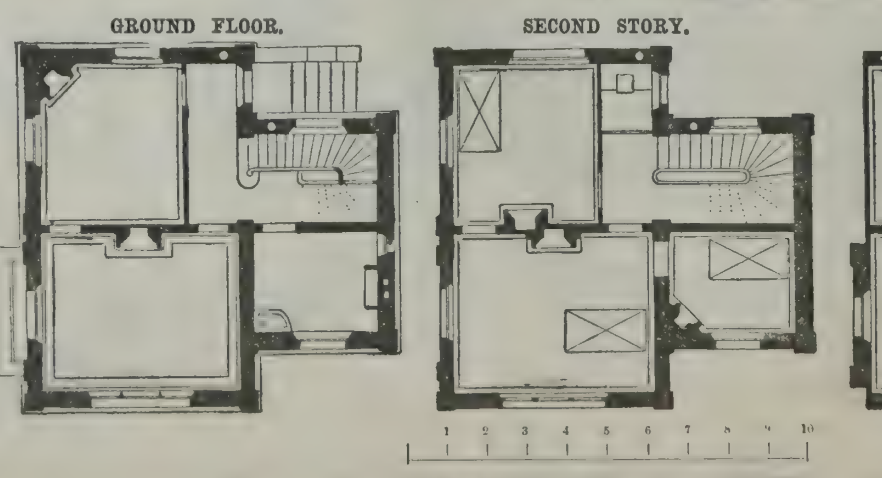
Our building is wood, built on brick pillars 5 ft. high, 18 in. wide, 24 in. long. The north and east walls are solid. The brick foundation of main building is all right, but all plastering on first floor is wrecked and gone, as is the case with wood buildings. You will notice in drawing inclosed, the distance that the bricks from chimney were thrown; that from the center of chimney to ground it is 22 ft. The tin roof does not appear to have been bruised by the bricks, but the force threw the brick in one mass on the ground. Again, the rocking motion caused a large tank, under the roof, to throw the water out, which, of course, ran all through the house. In getting out of our house, the motion was the same as a vessel at sea. Again, at our place of business, in a building used as a warehouse and shop, up stairs the floor has gone down 2 ft., and there is a large quantity of sand, of which I send sample, which was forced up and was hot. Also, when I reached the street, there was a fog of sulphur some 5 ft. above the street. It was so strong as to affect breathing. Many houses are stained with same. Two houses two squares below our place, 60 ft. long, have been moved sideways, one foot, as it were, suspended, and the shock sent the foundation one way and house the other. Tall chimneys in center broken and moved around, as well as tombstone or monuments affected same way. From my experience, electricity has had a great deal to do with the earthquake, as the following nights the whole heavens were ablaze, and shooting stars going in every direction. I give you the facts, that it may help to solve this fearful and wonderful convulsion of nature.

ISAAC H. HALL.
Charleston, S C.,
October, 1886.

A FRENCH COUNTRY HOUSE.

Our engraving shows a country seat in Vesinet, France (Seine and Oise), built by Architect Heret.

By the use of light and dark brick in the facade, and painted wood in the balconies and gables, a very excellent effect is obtained at a small expense. We give this engraving as perhaps containing suggestions that may be found useful to some of our readers.

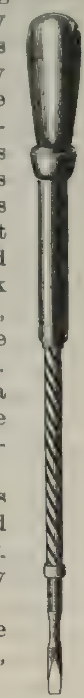


COUNTRY HOUSE AT VESINET.

To Wax Floors.

It has become fashionable to use white wooden floors, and for these it is necessary to have a preparation for waxing which will not discolor. Soxhlet, in *Neue Erfindungen und Erfahrungen*, gives a formula for a fluid which is perfectly white, glossy, and transparent, allowing the natural color and grain of the wood to be seen, and which only needs one application, to be repeated two or three times a year, and which hardens in two hours. Pure white beeswax in fine shavings, one pound, is boiled at a moderate temperature in five quarts of common soapmaker's lye, till completely dissolved. After removing from the fire, the solution is stirred for half an hour, and during this there is added to it, in small portions at a time, a solution of 35 grammes (1 oz. and 1 drachm) of sal tartar in one pint of water, until the entire mass foams. Then 70 grammes (2 ozs. 2 drachms) of glass gall (sandiver), dissolved in one half pint of lye, are added gradually; next, 70 grammes (2 ozs. 2 drachms) talcum venetum, rubbed to an even consistency in about a gill of lye, are added; and after the mass, with constant stirring, has nearly cooled, a half pint of alcohol is to be stirred in, and the polish is ready for use. It can also be used as a polish or finish for any light wood.

THE ALLARD SPIRAL SCREW DRIVER.



This screw driver is especially adapted for light and rapid work, and much time can be saved by its use where large quantities of small screws are to be driven. Placed upon the spirally threaded shank within the lower end of the hollow handle is a nut which is free to revolve within the handle. When the point is inserted in the nick of a screw and pressure is brought to bear upon the handle, this nut is raised slightly and brought into engagement with a clutch, which holds it so that continued pressure upon the handle revolves the shank and thus drives the screw. To draw a screw, the shank is pressed into the handle, when the tool can be used as a common screw driver. If desired, it may be used, when extended, as a common screw driver, by simply giving the shank a twisting jerk, causing the nut to recede and become locked.

It will be seen that the use of this tool does away with all tiresome turning of the hand and twisting of the wrist, all the work of driving the screw being accomplished by simply pushing.

The sole agents of this screw driver are the Alford & Berkele Co., of 77 Chambers Street, New York city.

The Store Order Act Invalid.

The Supreme Court of Pennsylvania, sitting at Pittsburg, on Oct. 4, decided the anti-store order system act of June 29, 1881, to be unconstitutional. The provisions of this act we condense as follows:

"Persons mining or manufacturing, or either, coal, ore, or other mineral shall pay their employes in lawful money, or by order redeemable at its face value in lawful money by the issuer within thirty days. Violation a misdemeanor, punishable by fine up to $100, to go to school fund. Employes interested in merchandising are not to make a greater profit on goods than outside dealers in like articles. Violation makes the debt uncollectible from employe. Employers refusing for twenty days to pay employes regularly or to redeem orders shall pay one per cent a month, if suit be brought for the amount due."

The court said: "The act is an infringement alike of the rights of the employer and the employe. More than this, it is an insulting attempt to put the laborer under a legislative tutelage which is not only degrading to his manhood, but subversive of his rights as a citizen of the United States. He may sell his labor for what he thinks best, whether money or goods, just as his employer may sell his iron or coal, and any and every law that proposes to prevent him from so doing is an infringement of his constitutional privileges, and consequently vicious and void."

Detecting Barytes in White Lead.

The most common attendant of white lead is permanent white, or sulphate of baryta. This admixture may be recognized by boiling a small quantity of the pigment in a glass test tube or flask, with nitric acid diluted with an equal measure of water. The white lead dissolves, but any sulphate of baryta remains as a white residue. To prevent any chance of error, the residue should be allowed to settle, the clear liquid poured off, and the deposit again treated with nitric acid and then boiled with water.—*London Coach Builder.*

NEW PASSENGER STATION, ROCHESTER, N. Y.

The New York, Lake Erie, and Western Railroad Company are making extensive improvements along their line. At Rochester, N. Y., they are now erecting on the south side of Court Street, near the river, the handsome building of which we give front elevation and ground plan. The style of the architecture is based on the modern renaissance, being treated in a free and unconventional manner, suitable for this class of building.

On the first story are waiting and other rooms, as shown on the plan, and on the second story are superintendent's office, conductors' room, divisional freight agent's office, hall, lobby, and toilet room.

The main building is 76 ft. 5 in. × 60 ft., with a total frontage on Court Street, including the projection of porch, etc., of 100 ft. A tower on the northeast corner rises to a height of 110 feet above the pavement.

Brick and stone have been used for the walling, with Medina stone laid up in regular courses of ashlar, with quarry faces and chisel draught below the first floor sills. Above this point, the exterior courses of wall are laid up with pressed brick in black mortar. Window sills, bracket corbels, keystones, and first story sill course are of Ohio sandstone. Trimmings of terra cotta and moulded brick are freely used in belt and string courses and in the arches. The roofs of main building and awnings are covered with slate and copper, and the roofs of wings with Gilbertson's "old method" tin.

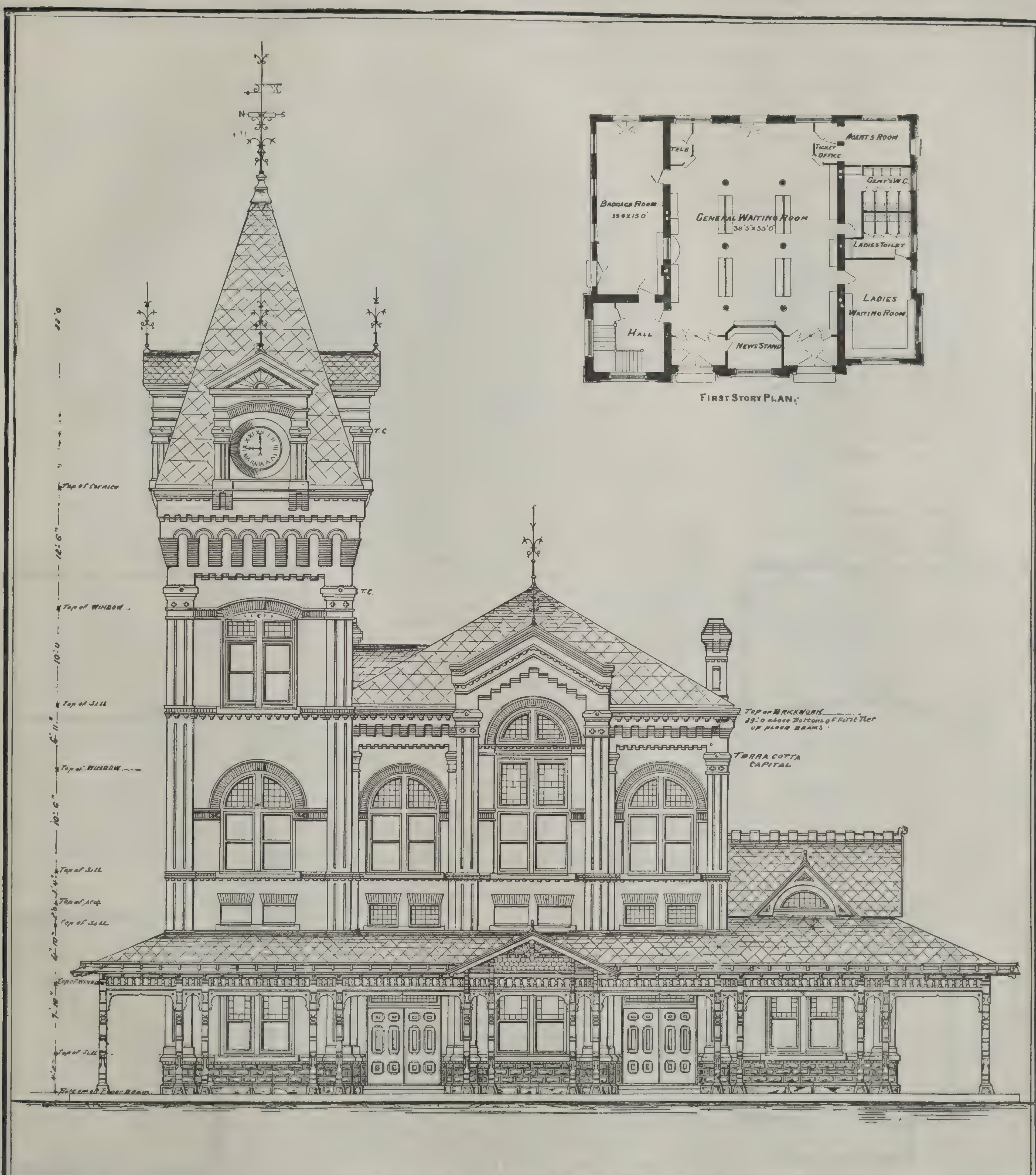
The interior of the building will be finished in white ash and cherry, the floors of waiting rooms and vestibules laid with black and white marble tiles, and the floors of the toilet room with slate tiles. An open staircase in oak, ash, and cherry is located in the tower.

Steam will be used to heat the building, and electricity for lighting. The tower clock has four 5 ft. glass dials, and will be lighted automatically by electricity.

A train shed 270 feet long and 72 feet wide, of ornamental design in iron, is to be erected adjoining.

The cost of passenger station and train shed will be upward of $50,000, and the buildings, when completed, will be a credit to the railroad company and an ornament to the city.

The work is being executed under the direction of C. W. Buckholz, engineer, from drawings and designs of George E. Archer, architect to the company, to whose courtesy we are indebted for the loan of the drawings from which our plate was made.



NEW PASSENGER STATION, ROCHESTER, N. Y.—N. Y., LAKE ERIE, AND W. R. R.

Drawings and Contributions.

To those of our readers who have a mind to employ their leisure time in writing articles for this paper, we would say, the editor will be glad to receive their contributions, and will publish such as are approved.

Articles on practical subjects, aimed to interest and instruct every class of artificers connected with building, are especially desired; and for such articles special arrangements will be made.

Architects and builders who have desirable plans of buildings, which they wish to see illustrated in our columns, are invited to send them in. For colored plates, we need copy colored up as intended. For ordinary illustration, the drawings should be executed in black lines. We aim to give prominent credit to the authors of new designs. Those whose drawings have been issued have derived therefrom much benefit, owing to the very wide publicity thus given to their names and work specimens. It should not be forgotten our Building Edition now has, by far, the largest circulation of any architectural periodical in the world.

A GOOD flux for soldering iron, brass, etc., is made by dissolving chloride of zinc in alcohol.

DESIGN FOR A DWELLING TO COST $1,500.

In its proportions and general arrangement, this house is adapted to an ordinary city lot, but would also be suitable for a village location. The designer of the house, Mr. John P. Cowing, 1643 Euclid Avenue, Cleveland, Ohio, observes that should it be desired, the parlor and sitting room may be connected by a door, and, as the plan shows, this may be a double sliding or folding door. Such an arrangement would doubtless be generally preferred, and is in our judgment one of the chief objects to be gained in locating the two main rooms, one directly in the rear of the other. When made to communicate by double doors, they can be thrown together, and two rooms of very moderate size will thus serve the purpose of a large reception room when occasion demands, while at other times each may be devoted to its especial use. This is a highly desirable measure of economy, inasmuch as the expense of maintaining two rooms solely for the entertainment of guests is a very serious item, yet many who cannot afford that luxury have now and then a gathering of friends for whom a parlor by itself is too narrow an accommodation.

The ceiling of the first story of this house is 9 feet high, and that of the second story is 8 feet 6 inches. The separation of the kitchen from the sitting room, making it necessary to pass from one to the other through the pantry, is intended to prevent the odors of the kitchen from circulating too freely in the other rooms. Should the sitting room be used as a dining room, it is suggested that a slide may be put in between the kitchen and the small china closet in the corner of the sitting room; or the closet may be put elsewhere, and a door substituted at this point.

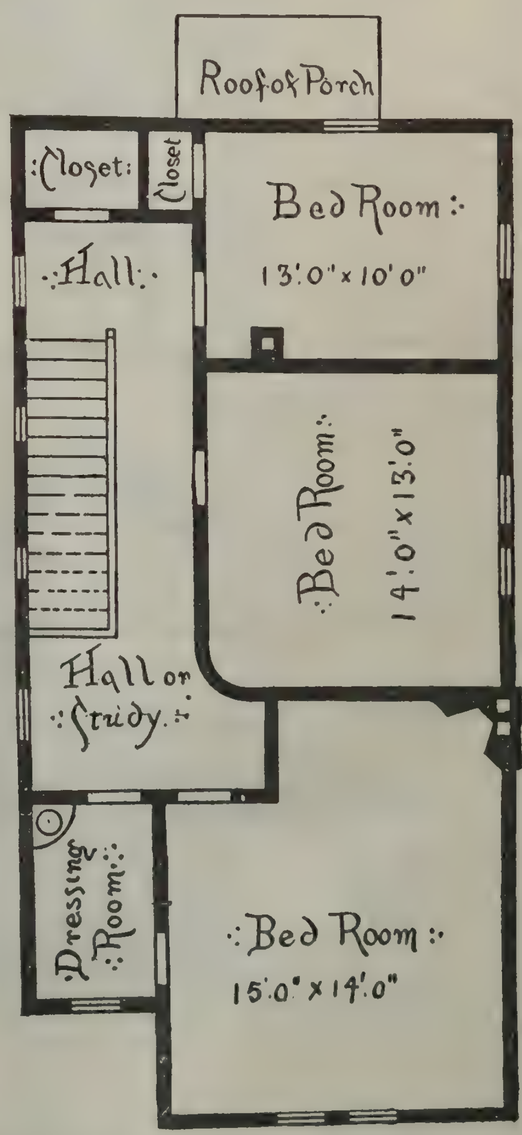
The estimate for this house is $1,487.40, and will cover the cost under ordinary conditions if judiciously applied.—*Mechanical News.*

FRONT ELEVATION.

SIDE ELEVATION.

DESIGN FOR A DWELLING COSTING $1,500.

Plan of First Floor



Plan of Second Floor

Our First Volume.

The first volume of our ARCHITECTS AND BUILDERS EDITION is now ready for delivery, bound in handsome paper covers. Price $1.50. To be had at this office, and of book and news dealers throughout the country. Those who have not seen a half year's collection of our numbers bound together will be surprised at the wealth and variety of contents which the volume presents, as well as at the cheapness of the price.

The volume contains all the numbers of the work from its commencement up to and including June, 1886. It embraces sixteen splendid plates in colors, representing the perspective elevations and plans of various dwellings, all having attractive features; eight large double sheets of details of construction of the same structures; nearly one hundred additional engravings of architectural subjects, public works, buildings, dwelling houses cottages, etc., with plans; and upward of three hundred other engravings, mostly of superior character, illustrative of works and subjects interesting to architects and builders. Including all the separate diagrams and engravings of construction details, the volume presents not far from one thousand illustrations. The reading matter covers a large variety of useful and excellent subjects, interesting to every one. No architect, builder, contractor, engineer, or householder can afford to be without this splendid work. It is beautifully printed, and is by far the cheapest architectural volume ever presented to the public.

Wood in Damp Places.

When unseasoned wood is surrounded by dead air it very rapidly decays, fine fungous growths extending through every part. After the rot has begun, the mere contact of decayed and sound wood seems sufficient to insure, by a catalytic action, its spread through the latter. This has probably led some observers to their conclusions that the accompanying parasitic plants, Merulius lachrymans (or L. vastator) and Polyporus hydridus, cause the decay. But the highest authorities now regard these growths as accessory, and beginning only after a suitable habitat has been prepared for them. Thus the fungus acts the part of a scavenger, and converts corrupt matter into new forms of life. The presence in the timber of the fungi spores is easily explained. The researches of Pasteur show that atmospheric dust is filled with minute germs of various species of animals and plants, ready to develop as soon as they fall into a congenial locality. He concludes that all fermentation is caused by the germination of such infinitesimal spores. That they elude observation does not seem strange, when we consider that some infusoria are only $\frac{1}{24000}$ of an inch in length. Admitting that they are only ten times the linear dimensions of their germs, the latter will be $\frac{1}{240000}$ of an inch long. But with the best microscopes we cannot perceive objects measuring less than $\frac{1}{80000}$ of an inch. These germs might find their way into the growing plant through both roots and leaves. The whole tree is thus filled with the seeds of decay, awaiting suitable conditions to spring into growing organisms. The prolonged vitality of spores, made necessary by this theory, cannot be a serious objection when we remember the vigor of the 'mummy wheat,' and the unknown plants which start from the earth raised from deep excavations. Indeed, time, even when measured by centuries, seems hardly to affect the vitality of vegetable germs. But what prepares timber for the germination of the fungi spores? Probably fermentation of the juices and semi-solids of the moist wood For fermentation, five conditions are necessary, viz.: 1. Presence of water. 2. Temperature from 40 degrees to 110 degrees Fahrenheit. 3. Presence of a ferment. 4. Presence of a fermentable body. 5. Exposure to the atmosphere. Three of these conditions almost always prevail. Very rarely, if ever, can we maintain the temperature of any timber construction below 40 degrees or above 110 degrees Fahrenheit. Probably countless numbers of ferment spores are annually absorbed into the fluids of the smallest sapling. Completely excluding any construction above earth and water from the atmosphere is practically impossible. The two remaining conditions we can generally prevent.—*H. W. Lewis.*

THE Government ship Atlanta, now nearly completed, is found to be from 180 to 280 tons heavier than she was designed to be.

THE STATUE OF LIBERTY, NEW YORK.

October 28, 1886, the day fixed for the public inauguration of this great work, will be memorable in the history of the metropolis of the New World. The assembly of distinguished personages, the official ceremonies, and the great pageant pertaining to the inauguration will have a widespread interest. For the special particulars of these, reference must be had to the daily newspapers. As to the work itself, its history, progress, and construction, we will here present a brief account.

The incipient, moving cause that gave origin to the work appears to have been due to the eloquent and suggestive ideas and expressions of M. Laboulaye, given many years ago to his particular friend M. Bartholdi, the sculptor. The actual scheme for the realization of the work was privately formulated within the circle of Bartholdi's friends in 1870. The plan for a popular subscription in France for the construction of the statue was made public in 1874; and thereafter various festivals were held for raising the money and the work was commenced. In 1876 a portion of the statue, the hand bearing the torch, was completed, sent to this country, and exhibited at the great exposition, Philadelphia, in 1876, and subsequently in New York. The act of Congress accepting the statue as a gift from the French people, and setting apart Bedloe's Island, in New York Harbor, as the place for its reception, was passed in 1877. Another portion of the statue, the head, was completed and put on exhibition at the Paris exposition in 1878.

The statue was wholly completed in 1883, and in the same year the building of the great pedestal on which the statue stands was begun on Bedloe's Island. The statue was formally delivered into the hands of the United States Minister in France, July 4, 1884, and in June, 1885, was brought over in a French war vessel, and landed in New York. The work of finishing the pedestal and erecting the statue thereon was completed in October, 1886. Such, in brief, is the chronology of this interesting work.

We give a series of engravings from which a fair idea

Fig. 2.—THE STATUE OF LIBERTY.—VIEWS SHOWING THE METHOD OF ERECTION.

of the appearance and nature of the structures can be gathered. Our front page engraving (Fig. 1) shows the appearance of the great statue, as it stands completed, on the little island of Bedloe, in New York bay, just at the mouth of the noble Hudson River, a short distance from where it issues from the rocky southern extremity of the long barrier known as the Palisades. The position of the statue is a very commanding one; it overlooks the great bay of New York in all directions, and is in plain view from the cities of New York, Brooklyn, Jersey City, Newark, and other large towns.

The pedestal is 149 ft. 10 in. high above water level. The statue is 151½ ft. high. Total height of statue above water level, 301¼ ft.

The cost of the statue is estimated at $250,000; the cost of the pedestal and the erection of the statue, $350,000. Total cost of the work completed and in place, $600,000.

The size of the statue is far greater than any other in the world, having a total height, with its pedestal, of 149 ft. 10 in. above the sea, while the celebrated Colossus of Rhodes was 105 ft., and that of Nero, by Zenodore, about 118 ft. The difficulties in the execution of the work, and the great care and skill required in its erection, now nearly brought to a successful issue, can be readily understood even by those unacquainted with the details of such work.

The design and modeling for the statue itself was a work of vast labor. A preliminary study model, seven feet high, was executed by the sculptor, Auguste Frederic Bartholdi, and, having been approved by him, another, four times the size, was prepared. This was very carefully studied and remodeled, and was then divided into a great number of sections, each of which was marked with a distinguishing figure or number.

The exact form of the statue was now settled, and the sculptor proceeded to construct models of the moulds upon which the copper casing or envelope which forms the entire exterior of the statue should be shaped.

Each section was then very carefully enlarged again to four times the size, and rough frames were prepared and lathed all over to conform somewhat to the shape of the section. Upon these the sculptor prepared his plastered models, as shown in the engraving, which represents Mr. Bartholdi at work upon them.

This was done in a specially constructed workshop of Messrs. Gaget, Gauthier & Co., in Paris, the enlargement being carried out with geometrical precision by means of a number of wires and leads attached to the pieces, from which measurements were taken off with compasses, each section requiring some 9,000 separate measurements.

As the models were completed, carpenters were employed to make wooden models from them by means of planks crossed or laid close together and cut out in silhouettes. Upon these the copper was moulded by blows from mallets, assisted by levers; the fine finishing touches being given with small hammers and rammers. Sheets of lead pressed upon the model were employed to assist in the moulding of the copper.

Iron braces, to be used in uniting the plates of copper with the main supporting truss, were next forged and fitted to the form of copper, and the sections were then carried to the yard and fixed in their places on the frame.

The form of the supporting frame can be seen by referring to Figs. 2 and 3. It consists of four massive angle iron corner posts, united by horizontal angle pieces, dividing it into panels, which are strengthened by steel struts and braces, arranged diagonally, and side extensions are provided to approach more closely to the contour of the figure. The smaller frames supporting the head and the extended arm of the figure are of lighter construction than the main frame, but are arranged on the same plan. The whole of this trusswork was designed and executed by the consulting engineer, M. Eiffel. On completion of the figure, it was taken to pieces and shipped to America.

During the time the statue was in course of erection in Paris, a suitable pedestal was being erected here for its reception. Bedloe's Island was chosen as being the most central one available, and, although small, it is yet of ample size for the purpose.

The successful appearance of the work depended to a great extent upon the size and design of the pedestal. It was essential that while presenting the appearance of solidity, strength, and magnitude necessary to accord with the great height of the statue, it should not be so large and prominent as to detract in any way from the beauties of the figure.

The pedestal, as erected from the designs of Mr. Richard M. Hunt, the architect, is very successful in point of size and general appearance, as can be seen from our engraving showing the final appearance of the statue.

The foundation is a solid concrete base, 52 feet 10 inches high, 90 feet square at the bottom and 65 feet at

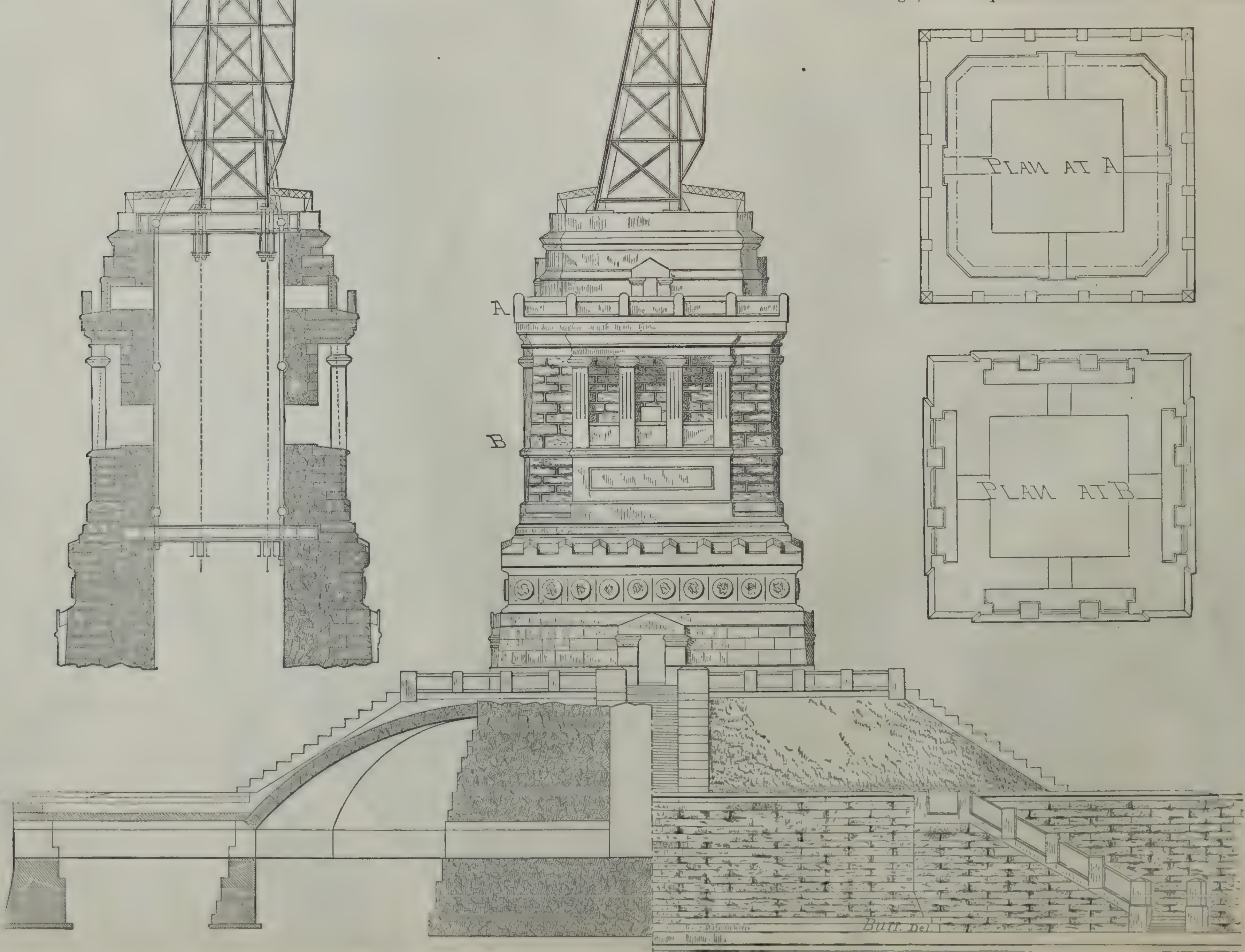


Fig. 3.—THE STATUE OF LIBERTY.—ELEVATION, PLANS, AND SECTIONS OF PEDESTAL, SHOWING METHOD OF ANCHORING THE STATUE.

the top, and is built upon a soil composed of stiff clay, gravel, and bowlders, to the terrace level, where the pedestal proper begins. This is probably the largest solid block of concrete in the world. Through the center is a well hole or shaft 10 feet square, with four arched spaces at the bottom leading therefrom.

Surrounding the concrete base is turned a concrete arch about 3 feet 6 inches thick, and having a chord span of 49 feet. This supports the grass mould covered over it to form a slope around the base, and it also supports the four flights of steps leading to the terrace.

Upon the concrete base is erected the pedestal proper, which is constructed of granite, with a concrete backing. The vertical section, Fig. 3, shows the construction. The top of the pedestal is shown in the plan marked A, and is 43 feet 6 inches square, the corners being cut off to form an octagon. The balcony at top is 3 feet 7 inches wide in the clear. The loggia, shown at B in the engraving, is 26 feet 7 inches high, the opening being 27 feet 11 inches wide and 13 feet deep in the clear. The columns are 3 feet 4 inches wide and are 6 feet apart. Around the base of the pedestal is the terrace, 15 feet 6 inches wide, and the staircases leading to it have a clear width of 10 feet. Shields bearing the coat of arms of the several States are arranged around the base.

The work of connecting and holding the statue by its framework to the pedestal was accomplished in the following manner, from the designs of General Charles P. Stone, Chief Engineer, under whose superintendence the work was carried out. (See illustrations, Fig. 3.) Across the top of the pedestal are placed six plate girders, arranged in two sets of three each, and immediately beneath these are two similar sets crossing at right angles at points exactly under the vertical corner posts of the supporting frame, to which they are united by three bolts, 5½ inches in diameter. The plate girders are 34 feet long, and extending across the well hole or shaft, which is 26 feet 6 inches square, have a bearing at each end of 3 feet 9 inches. The girders are 4 feet deep and are built of ⅝ inch web plate and 4 inches by 5 inches by ⅝ inches angle iron.

At a depth of a little over 60 feet below, is arranged a second and similar system of girders, 41 feet long. These girders are of the same thickness of iron as those above, but are only 3 feet deep, and are arranged two in a set. The two systems of girders are joined by four sets of eye bars, consisting each of four bars 4 inches wide and 1⅛ inch thick, placed close to the side of the walls of the shaft, and are prolonged to join the main frame at the top of the first or second panels.

The supporting frame having been erected upon the pedestal, presented the appearance indicated in the annexed engraving. The copper casing had then to be fixed in position. These copper plates are about $\frac{3}{32}$ of an inch in thickness, and were marked with figures as a guide in the re-erection of the figure.

In fixing each section the piece required was protected by a wooden frame or covering and raised by means of a rope attached to a derrick and engine, to the platform built around the top of the pedestal. From thence it was carried to the place where it belonged as indicated by the marks upon it, and it was then riveted to the adjoining plate and to the braces connecting it to the main frame. The work is carried up in courses in such a manner that the weight of each section is directly transmitted to the frame, being independent of the plates adjoining it.

Fig. 4.—WOODEN SKELETON OF THE LEFT HAND OF THE STATUE OF LIBERTY.

The copper plates are rendered rigid by being stiffened with iron bars ¾ inch by 2 inches, bent to conform closely to the curves in the copper, to which they are fastened by copper bands whose ends are riveted to the casing, forming a close network of bracing, covering and strengthening the whole statue. The inside view of the face in the drawing annexed shows the manner in which this is done, and the effect is to transmit pressure of wind and other forces acting on the thin outer copper through the various struts and braces to the main frame, which is firmly fastened to the pedestal as already explained.

The riveting of the plates is of three kinds. Where the joint is to be concealed, the edges are brought together and covered on the under side by a strip of copper, through which pass two rows of rivets with their outer heads countersunk. In other cases one edge overlaps the other and a single line of rivets pass through the overlapping edges, the outer one of which is hammered down where the location renders it necessary. A staircase is provided leading to the head, with steps up the outstretched arm.

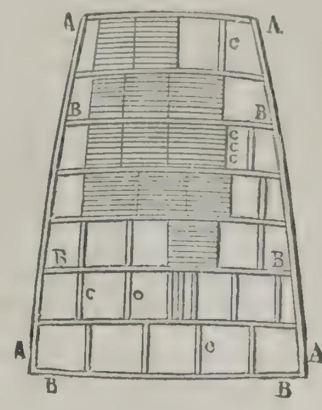


Fig. 6.

The principal dimensions are as follows:

	Feet.	Inches.
From bottom of plinth to top of torch	151·41	
Heel to top of torch	111	
Height of head	13	6
Width of eye	2	4
Length of nose	3	9
Length of forefinger	7	11
Circumference of finger at second joint	4	9
From water level to top of pedestal	149	10
Water level to foot of pedestal	60	10
Foot of pedestal to top of same	89	
From high water to top of sea wall	10	
Top of sea wall to foot of fort wall	2	6
Foot of fort wall to gravel level, at parapet of fort	23	6
Parapet to foot of pedestal	24	

The head will hold 40, and the torch 15 persons.

The total weight of the statue is 440,920 pounds, of which 176,368 pounds are copper and 264,552 pounds iron.

The object of the statue as a beacon is effected by the electric lighting now in course of erection. The statue itself is to be brilliantly illuminated from base to summit by four large lamps placed in front of powerful reflectors behind the parapet. They will be arranged out of view, to throw light on every part of the figure, which will thus be visible on the darkest night. On the balcony surrounding the torch are placed at equal distances apart eight lamps of 6,000 candle power each, with reflectors behind them.

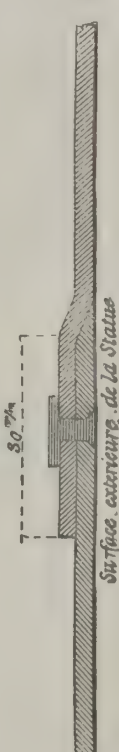


Fig. 7.

The whole structure in its final appearance is eminently satisfactory.

Long may it stand as an emblem of Freedom and a monument of the good will and friendship existing between France and the United States of America!

Fig 5.—THE STATUE OF LIBERTY.—HAMMERING A PLATE OF COPPER INTO A PATTERN.

A COAT of good, hard varnish on any machine after it has been neatly painted is worth ten times the cost of its application, because you can do more cleaning and wiping successfully in five minutes than you can on a coat of dead colored paint in one hour. The dirt slides off, and cannot stick and be incorporated as a part of the machine.

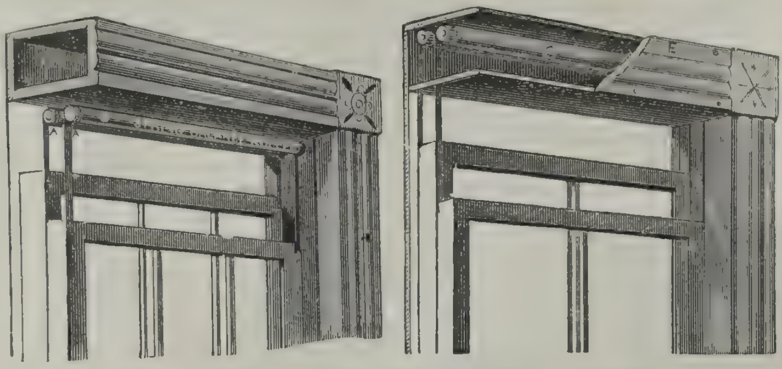
THE ORMSBY SPRING ROLLER SASH BALANCE.

The old-fashioned method of hanging our sashes with cords and weights possesses so many objections that it is surprising that it has not long ago been superseded. The difficulty has been to find a substitute which could be relied upon. Sashes hung in this way are constantly causing trouble by cords breaking and getting out of order, and pulleys becoming stiff ; but a still more important objection to their use is that the boxes containing the weights occupy a considerable space, which not only forms a large item of cost in the manufacture of the sash, but, in the case of small mullion, bay, and twin windows, one or more of them are prevented from being hung altogether in consequence of the space being insufficient for the purpose.

The Ormsby Sash Balance is designed to remove these objections and to provide a durable, efficient, and economical substitute. It consists, as will be seen from the engraving, of two parallel spring rollers—one for each sash—adjusted in the top box of the frame, and being usually constructed with a pocket for access to the balances. To the rollers are fixed metallic bands of great strength, which extend down through holes in the top jamb, and are screwed on to the face of the sashes. When the balance is to be applied to an old frame, the spring rollers are adjusted beneath the top jamb, and the bands connected with the sashes in the same way without disturbing the casing or plastering, as shown in the second engraving.

The metal bands are very durable, and sashes fitted with the balance move noiselessly and easily, even when large and heavy, and there is no likelihood of a sash "sticking," as it does so frequently when hung on cords and weights. When it is considered what the difference is between plain frames necessary for these balances and the ordinary ones necessitated by the use of weights and cords, it can be seen that there is a considerable advantage obtained by the use of these balances on the score of economy alone ; while for the reason of the smaller frames, more light may be admitted into a building, and, in addition, every sash may be hung, however small the jamb may be.

The Ormsby Sash Balance Co., of No. 92 Utica Street, Boston, and 93 Tribune Building, New York, are the manufacturers of this balance, and will forward further particulars and prices on application.



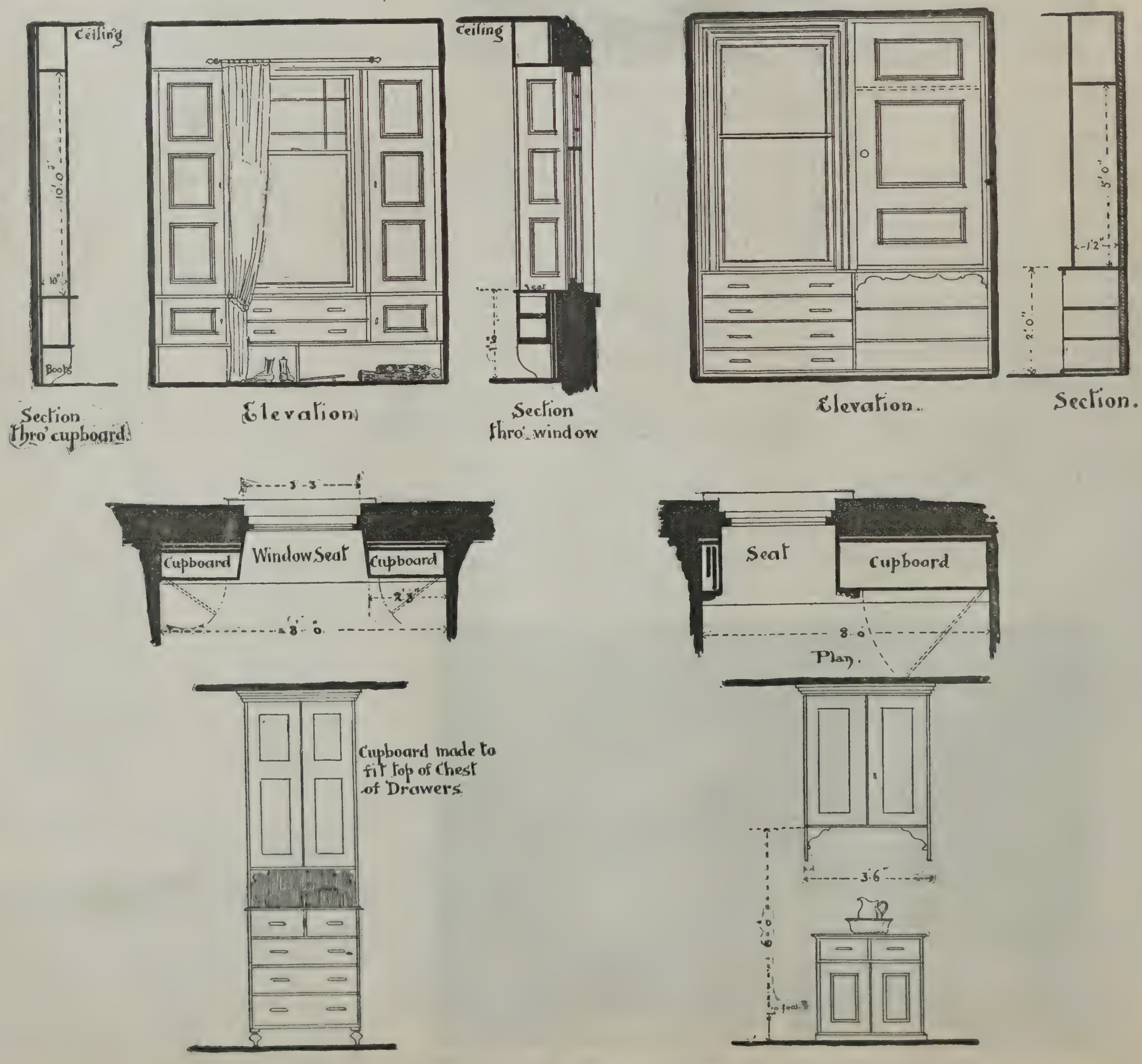
THE ORMSBY SPRING ROLLER SASH BALANCE.

COMFORTS IN SMALL HOUSES.

(*Continued from page* 83.)

We turn now to the "up-stairs," and see what we can do to please the "guid housewife" there. Here there are not many "fixtures," nearly everything is provided by the tenant, and is, strictly speaking, household furniture ; but closets are always useful, and it is decidedly advisable to use some of the floor space up for this purpose. We have, however, sometimes seen the bed-room floor of a house so cut up in closets that not one decent sized room remained ; and again, by way of attempting to get nooks and "pretty corners," a room is often spoilt. In small houses there is not generally space to spare for breaking up a room, and it is wisest to leave a bed-room, under these circumstances, as square as possible. But it is sometimes an advantage to shorten a long room, rather too long for its width, and here occurs an admirable place for a couple or more closets. This is of course a very ordinary arrangement, in which one closet opens out of each room, and the remaining space serves for a linen closet, opening into the landing of the stairs, or "upper hall," as it is sometimes called. But the difficulty is, in the very ordinary, plain, square arrangement of every day terrace plans, to obtain closets in other rooms that stand singly, having no room against which to abut end to end, and so dovetail closets as in the preceding case. Here, if you would attempt a closet on the long side of the room, you make the room itself too narrow, with an awkward projection into it, and the room is obviously too short to permit, for a moment, the thought of putting one at the end. A cupboard even 10 inches deep only, inside, is better than none, and 12 inches over all can generally be spared from the length of the room—the loss of floor space being in this case amply made up for by the cupboard which covers it. The following arrangement may be made a pretty feature in a room. It is this : To cover the bare space of the window wall with cupboards (as shown in the sketches).

These can be treated very simply ; plain square panelling or slightly moulded, to match the panels of the door of the room. A pleasant window seat is formed, and, with a little care and taste, this piece of "landlord's fixtures" may be made most useful. Drawers, as well as shelves, should be put in all these cupboards, unless they are intended for hanging cupboards only, and even then the articles to be hung are not sufficiently long to reach from floor to ceiling, so that there is still space for shelving. It must, however, be borne in mind, in putting up closets, that ample free space must be left



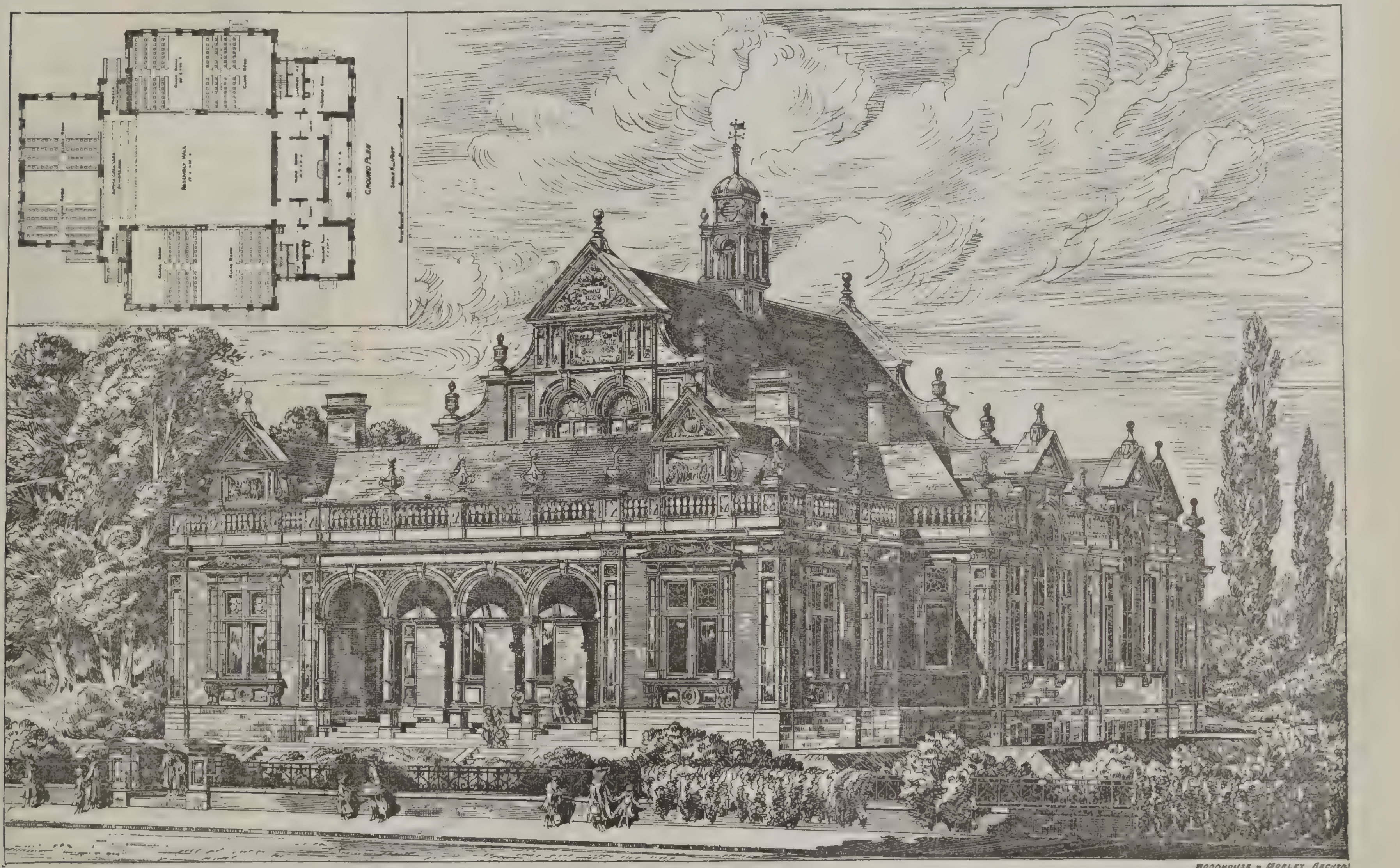
COMFORTS IN SMALL HOUSES.

in the body of the room for *air*. Where a chimney breast projects into a room, a recess is formed, into which it is a most natural thing to put a closet or a wardrobe, and if these are made fixtures, built into the house, the landlord would let his house sooner, and the tenant would be far more comfortable. All these cupboards should be carried right up to the ceiling, so as to have no shelf on the top on which dust can accumulate. They should be provided with a rail and hooks, and a shelf or two inside; the doors should be taken down to the floor, or else the cupboard should have a floor of its own. (See sketch.) The plan of having a rail at the bottom of the door is most objectionable, as it entirely prevents the cupboard being swept out, and before long the dust and bed-room fluff will have collected in all the corners, making a tempting place for insects to lodge in. In a very small room, it is not a bad plan to consider where the wash-stand will be placed, and, leaving room for it, and sufficient space for the person to use it without knocking his head, put up a cupboard on the wall, securely fastened to the studs of the partition, and support by beams if necessary. But perhaps it is safer to omit a cupboard in a very small room, and leave all the clear space for air. When the sloping roofs cut off parts of the outer walls, a door can be put into the space above the eaves and a closet comes about that the place up stairs corresponding to the hall below seems most fitted for the bath. But this may sometimes be a most inconvenient place. The bathroom often serves as a dressing-room, and, if it is to be so used, it should be near the principal bed-room; but, at the same time, where there is a family of small children, it is well to consider whether it would not be of greater service if put near the nursery.

In houses intended to accommodate a family of several young children, a nursery should be specially planned; every room will not do for a nursery, nor will every situation. There should be a couple of rooms devoted to this department, a "day" and a "night" nursery, opening one into the other, and both having doors opening upon a landing; and it is a great thing, if it can be afforded, to have small bathroom opening out of one or other of the rooms. A full sized bath is not required, so that a very small space will do; and rather than have none at all, the space that would be used as a closet may very well be used for this purpose. Another important item in a nursery is the windows. Children want to see out, and it is therefore advisable to make the windows long, almost down to the floor. If there is no balcony outside, have a permanently fixed grating, so arranged that a child cannot climb up it, and then the window will be quite safe. gallery is also provided at the end of assembly hall, to be used either for spectators or musical performers. Other rooms are provided in basement for use by the brass band of the firm, and for play rooms in wet weather, and to which separate staircases give access.

The whole of the basement rooms are lined with white glazed bricks, the class rooms are lined with cane-colored glazed bricks, also the teachers' rooms, cloak rooms, porches, etc. The teachers' rooms and class rooms have a dado of pitch pine, and the cloak rooms and porches have dadoes of tinted bricks. The front entrances have a dado of faience work, and the whole of the walls of assembly hall are to be lined with this work. The class rooms have open pitch pine roofs, and the large hall has an open roof of pitch pine and walnut. Stained glass will be used for the windows of assembly hall and portions of the class rooms. The exterior is of brick, with stone dressings. Polished granite columns are used for the loggia. The architects are Messrs. Woodhouse & Morley, of Bolton and Bradford.

SOME one has been calculating the distance a pen travels in the hands of a rapid penman, and he concludes that he can write thirty words in a minute. To do this, he must draw his pen through the space of a



NEW SCHOOLS FERGUSLIE WORKS PAISLEY FOR MESSRS J. & P. COATS.

placed here with boarded side, proving very useful for boots or other small things. In houses of the size we are referring to, there is not room for many features which add so largely to the comfort of living. We can have no "housemaid's closet" for the storage of brooms and pails, containing a sink for hot and cold water laid on; cupboards for half a dozen different things, such as cloths, and soon we can hardly find space for a "cubbyhole" into which to put this useful sink alone; and so all the slops must be poured down the water closet—an objectionable method of getting rid of them, certainly, for some reasons, but still the only one left to us. We have seen many a ceiling below a water closet spoiled by the oversplashing of slops; but by putting a "lead safe" on the floor all round the trap, covering the whole space of the floor under the water closet, this ruination to the ceiling can be avoided. The "safe" should have a waste pipe opening, if possible, on to some sink or grate, where, if there is an overflow, it can be detected, and by which, in case of the pipe being stopped, the stoppage may be proved and renewed before damage is done. Hinge the seat as well as the lid, that when water is being poured down the woodwork may not get wetted, and the closet will remain sweet and clean, and take care to make the closet fittings of *hard wood*. A bath should be put in every house, no matter how small, and, if at all possible, lay on hot water as well as cold. The position of a bath-room is a matter of some consideration. It is usually put over a hall, for the simple reason that halls are, as a rule, narrower than rooms, and a bathroom does not need to be so wide. Hence it

It is a good thing to have a good wide balcony outside the day nursery windows (which should face a warm quarter), with a safe railing and a comfortable shading roof. Children can hardly have too much light and air.

We have alluded to many items which add considerably to comfort, and can be easily and inexpensively arranged, when planning the house, and these are perhaps among the most important, although there are still many unmentioned here; but it is hoped these will be sufficient to act as a guide in planning, and set the author of the design thinking what else he can introduce, in the direction of the purpose here indicated. R. W. G. B.

DESIGN FOR A SCHOOL BUILDING.

We give, from the *Building News*, an elevation of the new schools, Ferguslie Works, Paisley, which are being erected for Messrs J. & P. Coats, thread manufacturers at Paisley, and are for the education of their half-timers (girls). They are intended to take the place of their present schools, which are inadequate for their requirements, and are also intended to be used for concerts and other entertainments. The central hall is 58 ft. by 38 ft., and grouped around this hall are six class-rooms (25 ft. 6 in. by 24 ft.), having glass screens toward the hall. To the front are teachers' rooms, cloak rooms, water closets, etc. There are also porches at the back, opening into playgrounds.

As the building is intended to be used occasionally for tea meetings or banquets, accommodation is provided in the basement for cooking, a small hoist being arranged to bring up the viands to ground floor. A

rod—sixteen and one-half feet. In forty minutes his pen travels a furlong. We make, on an average, sixteen curves or turns of the pen in writing each word. Writing thirty words in a minute, we must make 480 turns to each minute; in an hour, 28,000; in a day of five hours, 144,000; in a year of 300 such days, 43,200,000. The man, therefore, who made 1,000,000 strokes with his pen was not at all remarkable. Many men—newspaper writers, for instance—make 4,000,000. Here we have, in the aggregate, a mark 300 miles long to be traced on paper by such a writer in a year.

Artists' Supplies.[1]

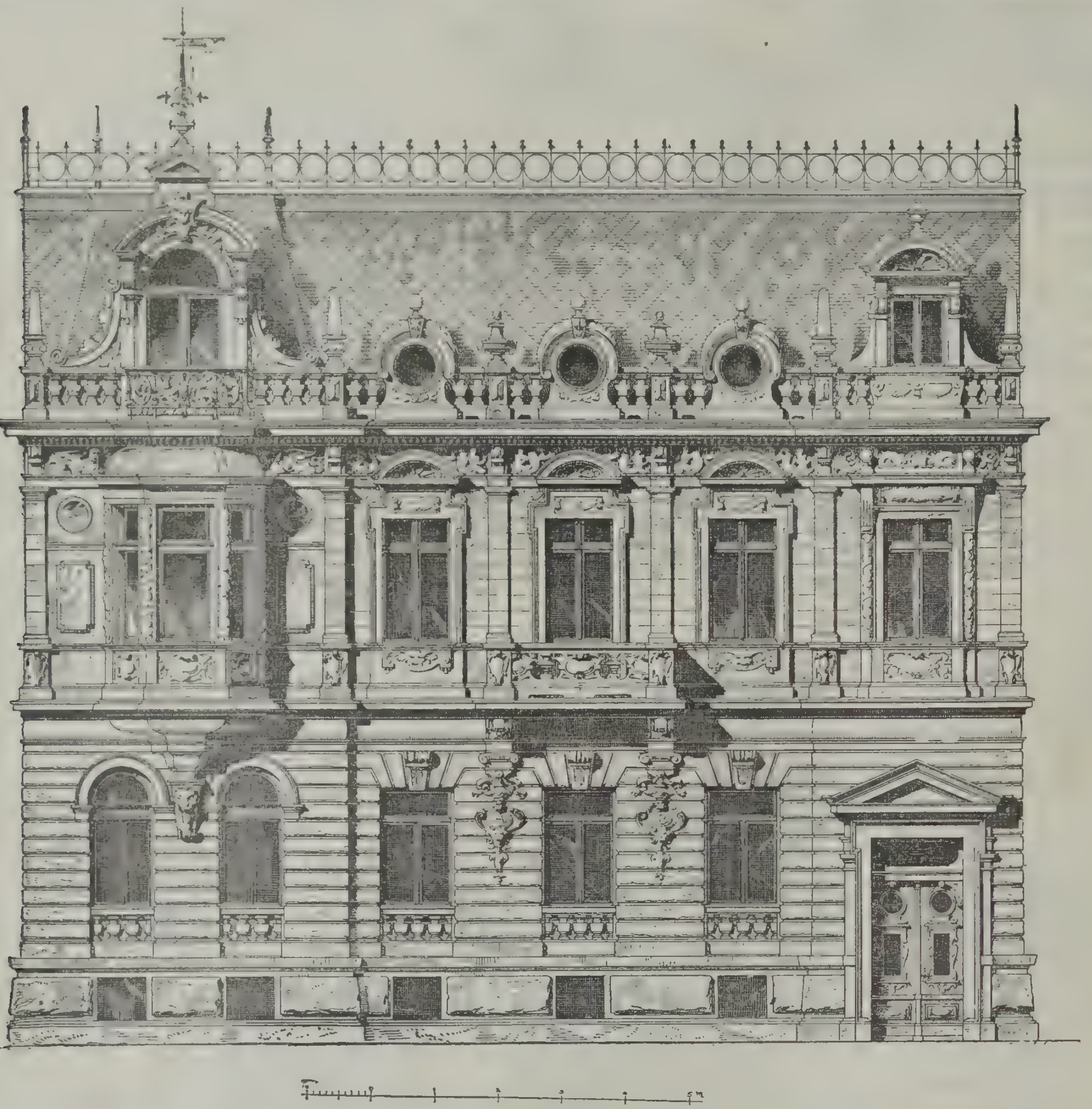
Messrs. Wadsworth, Howland & Co., of 84 Washington Street, Boston, Mass., and 190 Michigan Avenue, Chicago, Ill., have sent us a copy of their recently issued catalogue of Artists' Supplies and Materials, and Architects' and Engineers' Instruments and Stationery. It is profusely illustrated, and is exceptionally complete in its contents, which include a fine list of drawing instruments, squares, triangles, etc., of all qualities, and an exceptionally long and complete list of moist, dry, and cake colors of various manufactures. Drawing paper, tracing linen, and paper of all kinds are priced, together with all other material required by the draughtsman and artist. Among the new instruments described in the catalogue may be mentioned the adjustable curve ruler, which is designed to supplement the well-known French curves, and consists of a flexible edge covered by sleeves, the retaining power being a strip of pure drawn lead sliding between two ribbons of tempered steel. The working edge is semi-cylindrical in cross section, and can be instantly adjusted to any curve, forming a most excellent and handy tool. A well selected list of art publications is also included in the catalogue, and those of our readers who use this class of goods will do well to send to Messrs. Wadsworth, Howland & Co. for a copy.

A COUNTRY RESIDENCE COSTING ABOUT $2,500.

The perspective view and floor plans convey the general features of the design so fully that but little need be said by way of explanation or comment as to the interior appearance of the house, or the size and arrangement of rooms. It will be observed that all the rooms are large, both above and below, and that direct access is had to all the chambers from the stairway and hall. The feature of a front hall and staircase as commodious as those shown here is of itself a striking excellence, the value of which will be daily appreciated by the occupants of the house.

The first story of this house is 9 ft., and the second 8 ft. 6 in. in height. The cellar, which extends under the whole house, is 6½ ft. in the clear. The wood finish is selected pine, painted two coats; simple wood mantel in sitting-room; plaster, "one coat" work well smoothed over and finished. The hall stair is finished in black walnut, with square newel post, simple turned balusters, and 2⅞ in. moulded hand-rail.

A very general impression seems to prevail among those who build, either for rent or for their own occupancy, the cheaper class of houses, that a front hall and stairway is a luxury to which none but the rich can justly aspire. That this is an error we have shown both in the present design and in former plans of houses costing less than half the price of this. A front hall ought to be regarded, if not in the light of a necessity, at least in that of a very substantial comfort which amply repays the cost of construction. An outer door opening into the room in which guests are entertained is an awkward arrangement. So is a main stairway leading from the rear of the parlor or sitting-room. Both can be avoided with economy.



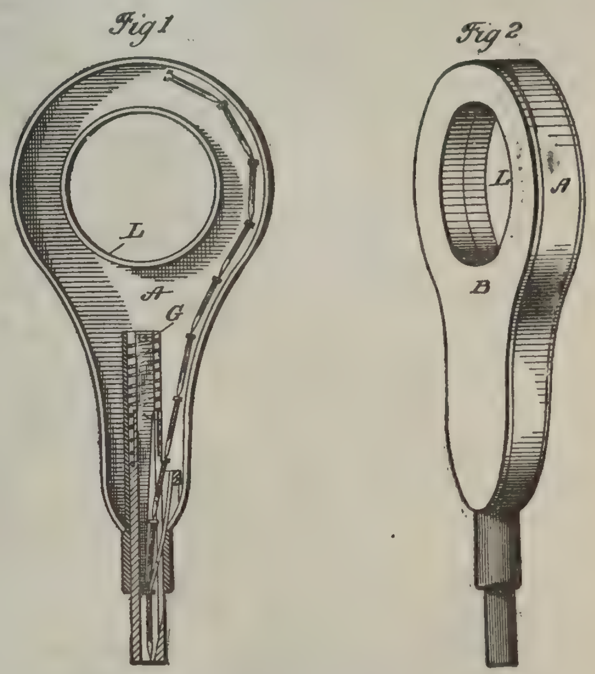
DESIGN FOR A HOUSE FRONT, CARLSRUHE.—BY PROF. C. SCHICK.—From *Architektonische Rundschau.*

The estimate of cost for this house made by the architect, Mr. Edward Dewson, of Boston, Mass., is $2,545.50, which allows of a very superior quality of material and style of construction. The same plan could be carried out, with cheaper material and plainer finish, for a sum considerably below that figure.—*Mechanical News.*

NAIL-DRIVING MACHINE.

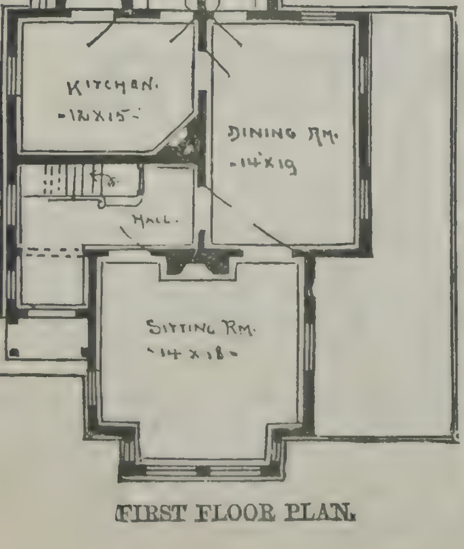
BY THADDEUS FOWLER, SHELTON, CT.

A suitable length of the nails is coiled around the hub, L, within the case, and its forward end led downward through the yoke and into the sliding nose, so that the position of the nails relative to the mechanism of the driver is as shown at Fig. 1—that is, the driver-toe is in engagement with the head of the lowest nail, and the point of the feed spring is also in engagement with the head of the nail, but upon the side opposite to the driver-toe. To drive the nail, the extremity of the nose-piece is placed upon the spot where it is desired to set the nail, and a smart blow struck upon the top of the case. This forces the sliding nose-piece backward within the guide tube against the action of the spiral spring until the nose-piece is entirely within the tubular projection and the nail firmly driven. In the downward course of driver and nail the tapered interior of the nose-piece sets the nail toward the wedge-shaped toe, whose point severs the nail from the string. The upward movement of the nose-piece carries the yoke and spring upward with it, and the extremity of said spring engages with the head of the nail next above that just driven; then, as the resiliency of the spiral spring returns the nose-piece downward to its normal position, the string of nails is drawn down by the grasp of the feed spring to the position shown at Fig. 1, and ready for driving.

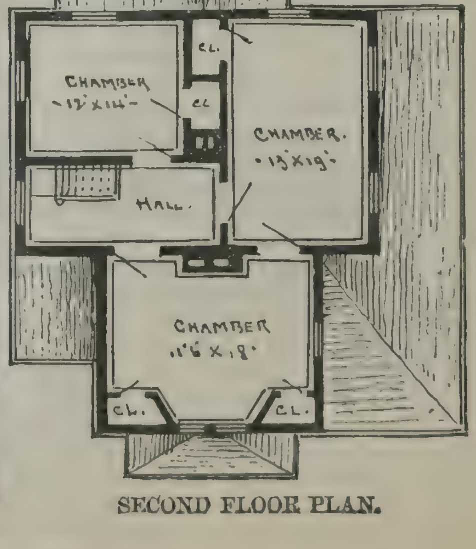


NAIL-DRIVING MACHINE.

A NOVEL barometer is said to be in use in Nuyren, Switzerland. There is old, an unused well in the village, the mouth of which has been closed with a wooden covering and hermetically sealed all but a small aperture in the cover, which is provided with a whistle. When a storm is brewing, the atmospheric pressure being decreased, the air contained in the well will escape, blowing the whistle and giving the signal of approaching storm.



FIRST FLOOR PLAN.



SECOND FLOOR PLAN.

A COUNTRY RESIDENCE COSTING ABOUT $2,500.

A MODEL SCHOOL BUILDING.

The cut presented on this page is a representation of the ground plan of what we consider a *model* school building for towns and cities, when the cost of construction and the adaptation of the building for school room convenience is considered.

It is a two-story, eight-room brick house, with wardrobes for each room. On the second floor, in addition to duplicates of the rooms on the first floor, is a large principal's room, of the width of two of the wardrobes, and those thus used are substituted by wardrobes over the stairways.

It will be seen by the plan that the building is compact, with hall space and stairways, well lighted and without waste room, and the teacher, standing in the center of the hall, has complete oversight of the pupils passing out of or into the wardrobes, or as they come down or go up stairs in line.

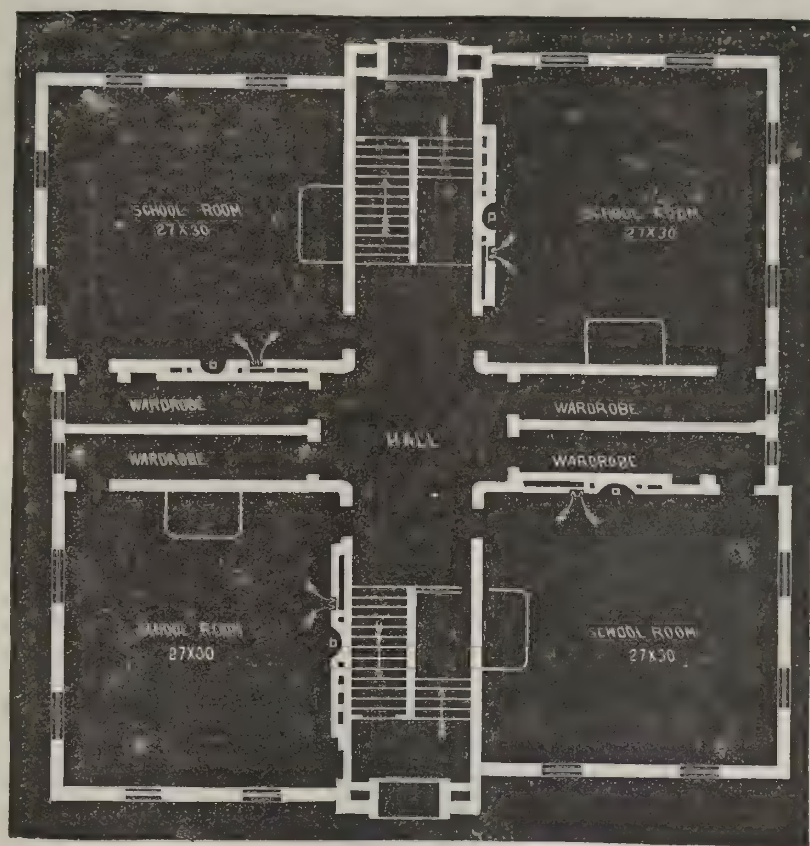
The cost of a substantial building constructed on this plan, of the very best material, including janitor's house and water closets, is $12,000.

In this city (Indianapolis), eight of the twenty-six public schools have been built from this plan, each room of the building being heated independently by a ventilating stove.

Fresh air is introduced from the outside which passes through the stove, and insures a pure heated air. The foul air is drawn through a register level with the floor, into a foul-air duct, and the lifting power is obtained by its being heated from the smoke flue adjoining, which is found to be sufficient to procure thorough ventilation and a rapid change of air in the school room.

In referring to the buildings erected on this plan, the Superintendent of Public Schools of Indianapolis, Ind., says:

"Since the organization of the present board, or system of managing the public schools of the city, only two-story buildings have been erected, with ample play grounds. Eight brick two-story, eight-room buildings of the size and arrangement as shown in this plan have been erected, and it is probable that all eight room buildings built hereafter will be upon the same plan, as there does not appear to be much room for improvement."—*Trustees' T. Journal.*

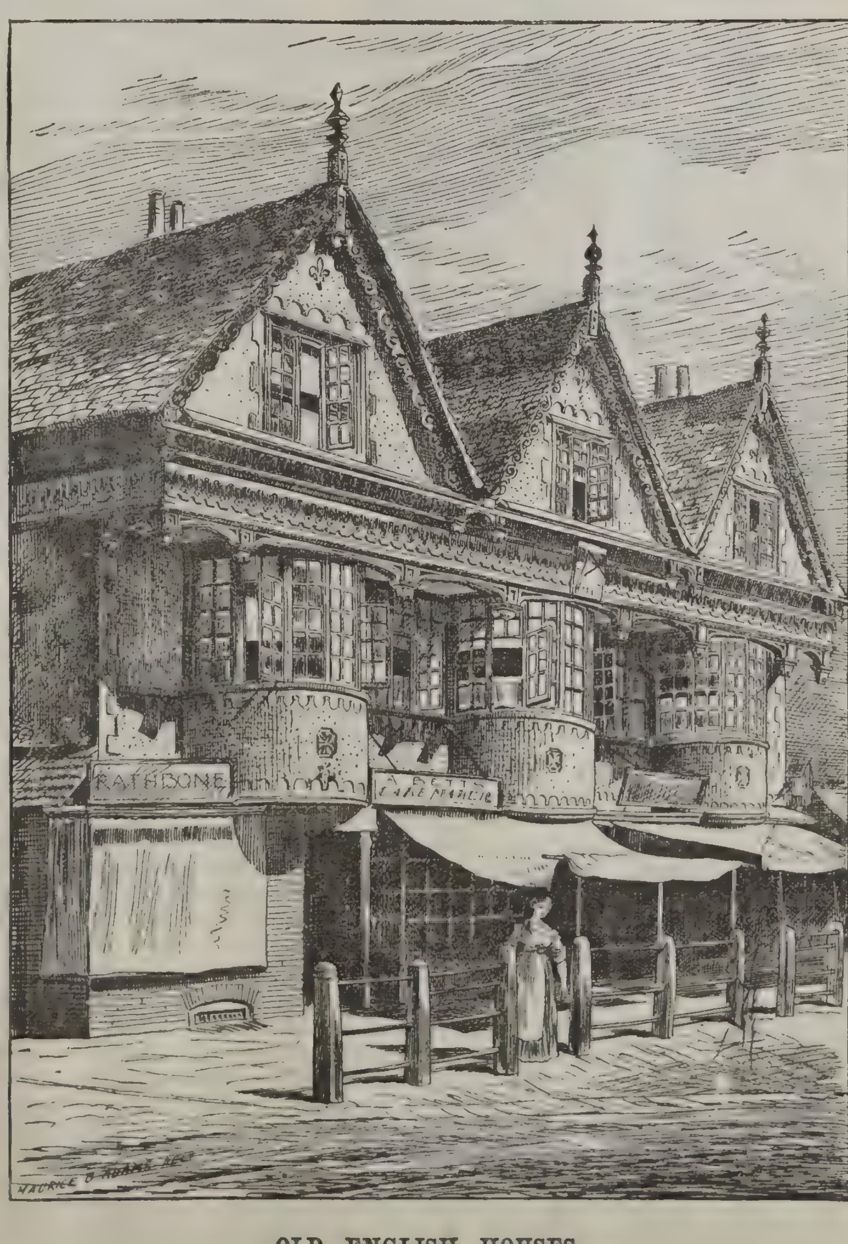


PLAN FOR A SCHOOL BUILDING.

OLD ENGLISH HOUSES.

Many of the examples of old architecture found in the more rural districts of England are of considerable interest and value, being often prolific in points of suggestion. Our engraving shows a group of three old houses and shop fronts erected in a particularly picturesque manner. The effect produced by this group is very pleasing. The quaint, low windows, with their small panes, and the overhanging gables, with their ornate barge boards, produce an exceptionally attractive effect, while the deeply moulded and ornamented cornice gives a character and boldness to the whole design. The walls are finished in the style of plaster work known as "rough cast," and the roof is covered in with plain red tiles.

Our engraving is taken from the excellent drawing of Mr. Maurice B. Adams, F.R.I.B.A.



OLD ENGLISH HOUSES.

Arrangement and Protection of Water Pipes.

How shall the water pipes in a house be run and arranged?

This is, so far as subsequent annoyance owing to the constant necessity of repairs is concerned, one of the most important matters connected with the water supply of a house, and far too little attention is in the majority of cases paid to it by architects and builders. In the first place, it is important that all lead, and also tin lined and block tin, pipes be well fastened to boards or narrow strips of wood nailed to walls or ceilings. Vertical lead pipes should be supported by soldered hard metal tacks to the lead pipes, and fastening them with screws to the board. All sagging is thus effectively prevented, provided the supports are not placed too far apart. Horizontal or graded lead pipes should be firmly supported wherever possible throughout their entire course by strips of wood on which they rest, and must be kept in place by brass bands or clamps. Sometimes it is necessary to fasten horizontal lead pipes to boards nailed to the under side of ceilings. In such a case, the supports must be placed very close together—say every two feet. If insufficiently fastened, lead pipes are soon dragged down by their own weight, besides being affected by changes of temperature, for when hot water passes through the pipe it causes the pipe to lengthen, and hence to sag, while lead does not return to its original shape on cooling. Once out of line, pipes become air-bound, or freeze in winter, and leak.

Hot and cold water pipes should be kept at least one-half inch, and better one inch, apart to prevent loss of heat from one to the other; and where they run in the same direction, must be fastened truly parallel to each other. Faucets, and in particular ground key and self-closing bibs, should not be placed at the end of a line of supply pipe, where this can be avoided, but should be taken from the side of the pipe, and the pipe suitably continued so as to form a small air chamber.

In arranging a system of service pipes in a dwelling, the cardinal rule should always be observed that all lines of supply pipes be so graded that they may be readily and completely emptied at some stop and waste cock or draw-off faucet when the water is shut off from the house. This is very important in the case of severe cold weather to prevent the freezing of pipes, and is an absolutely necessary condition in the case of all houses left empty during the winter months, such as summer and seaside residences, etc. In this connection it may be well to state that no check valves should, as a rule, be used in lines of supply pipes. Where used, their number and location should be remembered and noted by the house owners, for such check valves interfere with the complete emptying of pipe lines.—*William Paul Gerhard, in Good Housekeeping.*

Insufficient Timbering in Houses.

Modern builders have found out that the element of strength in a beam is the depth, and they have carried this principle to such an extent that we now see boards on edge made to answer as joists. I do not so much object to the deficiency in thickness in joists, if they are well strutted, as to the want of sufficient depth in proportion to the span. Many persons are so ignorant of the strength of timbers that they have a stereotyped scantling for joists, which they use for all spans in small houses. The result of such a system may be easily imagined; in some cases they have more than sufficient, and in others the deflection is considerable. Of all portions of timbering, there are none so often scamped as the lintels; and when we consider the small proportion they bear to the total quantity of timber in a building, it is surprising that men will injure the stability of a structure by crimping their scantling. Gutter plates in V roofs also afford a grand opportunity to the cheap constructor to save timber. It is unnecessary to state that he does not hesitate to avail himself of it. Consequently, in a short time there is a permanent set. This is one of the causes of leaky roofs. Light rafters of long span are among the things to be avoided in construction. A really good, strong roof may be easily constructed by the introduction of a light truss, or by trussing two of the rafters, and placing the purlin upon the crutch formed at the junction of the strut with the rafter. By this means in small houses the span of the rafter is reduced to a minimum, and one of small scantling may be used with beneficial results. The construction of roofs by judicious trussing is a matter in which scientific knowledge will give the architect an immense advantage, enabling him to design a stronger structure with the same quantity of, and in many cases less, material. In the present mode of designing shop fronts, the brestsummers are mostly formed of a balk of timber resting upon story posts of small scantling, and in many cases without any ties to the joints to prevent the entire front from pitching into the street.—*J. Lemon.*

Shingles 115 Years Old.

A Danielsonville correspondent of the *Sun* writes as follows about the shingles removed a few days ago from the steeple of the Unitarian church at Brooklyn: "One of the first pastors of the church nailed them with big-headed wrought iron nails to the steeple in 1771, and under them General Israel Putnam often has sat and listened to the discourses—rare in these days—giving liberal interpretations of the Scriptures. It is stated, also, that the shingles were 'rived' by men who afterward fought with Old Put at Bunker Hill. The shingles are remarkably well preserved. Four of them are displayed in the street windows of the *News* office, in this village, and above them is a placard with this reading: 'These shingles were in use on the Unitarian church in Brooklyn, 115 years. Just look at the nails.' The nails are fine specimens of old-fashioned, painstaking workmanship. They are smooth, straight, and round, with large, thin, perfect heads, and are as clean and bright as at the time they were driven into the steeple. They would be considered to-day too valuable to use in any except the most elaborate and costly work. The shingles, of red cedar, are not at all decayed."

THE NEW CONGREGATIONAL CHURCH, HYDE PARK, ILL., is located on the northwest corner of Drexel Boulevard and Fortieth St. The building is approaching completion. The size is 80×100 ft. Contains audience room, reception rooms, pastor's study, ante rooms, etc. Seating capacity, 700; gallery across front accommodates 150 more. Galleries may be extended to sides in the future if required. Superstructure is of dark artesian well stone, roof of black slate, interior finish entirely of oak, artistic cathedral glass in windows, and interior walls and ceilings highly decorated. The church will be heated by steam, and lighted by electric lights. Cost, complete, $60,000. G. H. Edbrooke, of Chicago, architect. We are indebted for our sketch to the *Building Budget.*

THE NEW CONGREGATIONAL CHURCH, HYDE PARK, ILL.—GEO. H. EDBROOKE, ARCH.

The Proper Construction of Stone Houses.

There is no more prolific source of trouble, both to builders and owners of stone houses, than that caused by water penetrating the walls and getting in over the windows after a heavy rain.

The causes producing this trouble being well known, it would seem an easy matter to overcome them, and all sorts of suggestions to that end have been made, but so far with no effect.

The present time, therefore, would seem an opportune one in which to offer a practical solution of this trouble, and that is the purpose of this article. The underlying cause of all this trouble is haste to finish the building; hence, the first thing to be done, and without which all else is practically useless, is to "make haste slowly." Time should be given the mortar to harden, the building to settle, and the cracks to show before the pointing is done. No stone house should be pointed the same year it is built, for two reasons: First, the cement used in pointing forms a barrier to the evaporation of the moisture in the mortar in which the stone is laid, and prevents it from drying. The pointing, while keeping the moisture from coming out, will not prevent the frost from going in and freezing the mortar; this will produce an expansion, which causes the pointing to lose its grip on the mortar, and creates innumerable crevices through which the water easily finds its way. Secondly, all stone buildings, even when built in the most careful manner, have a tendency to settle. This settlement cracks the pointing. In many cases these cracks are so fine as to be scarcely visible, especially if some distance from the ground. But no cracks are too small for water to penetrate, driven by the force given it by the wind from an open sweep of miles, as it has in many parts of this country. It is absolutely essential, therefore, that the mortar should have time to evaporate all its moisture and become thoroughly dry, and the building time to settle, before pointing.

Houses built with stone, and having all the windows arched solidly through the entire thickness of the wall with brick, seldom have water dropping from the soffit of the frame; for if any water should beat through the stonework or cracks in the same, the bricks, having power to absorb so much of the water, hold it while the rain lasts, and after it is over evaporate it to the outer air.

When impracticable to use brick over the windows, from architectural or other reasons, a piece of sheet lead, going through the entire thickness of the wall, and extending about one foot each side of the window, and turned up two inches on the inside, will hold the water until it evaporates.

A style of architecture much in use at this time necessitates exposed gables. These gables are usually finished so late in the season that the mortar has not time to dry before the frost sets in, and in consequence the mortar freezes. Mortar once frozen loses its adhesiveness, and therefore has no life in it. The proper and only safe plan is to use Portland cement and sand (no lime) in all gables. This will set in one-tenth the time of lime mortar, and will be hard and dry before frost comes.

All stone gables that rise above the roof, and are only protected by stone coping, should have a sheet of lead to cover the entire wall put on under the coping. This lead should project over the inside of the wall, and be turned down over the flashing of the roof. By this means, all water that gets through the joints of the coping will be carried off. In conclusion, with care and a proper observance of the natural laws governing the materials used in its construction, a stone building can be built in the present day just as tight as years ago, when people did not expect to excavate the cellar in the spring and move into the finished house in the fall.—*The Builder.*

Harmony in Decorations.

Paint woodwork natural color of cherry. Paper the walls in lavender. Tint the ceiling a golden olive color of about the same value as the lavender paper in tone. Tint the ceiling moulding in lavender, golden olive, and the color of natural cherry, only a little lighter than the woodwork. Use an eighteen inch frieze of a medium dark Indian red flock, or else cartridge paper with a border on either side showing a golden olive ground with a floral design in yellows, old pinks, and olive greens with touches of gold only; the borders to be six or eight inches wide; a natural cherry picture rail to separate the frieze from the lavender wall paper. Stain the floor a mahogany red and varnish with strong shellac; it will need going over afterward with an oiled rag to keep it in beautiful order.

Painting Floors.

Now that the fashion is more and more prevalent of using carpets that do not completely cover the area of the floor, and which thus escape distortion by being so cut as to coincide with every angle, recess, or curve of the walls, floor painting should certainly be more generally adopted. Painted borders are all well enough, but the whole area of the floor may be advantageously laid out in color. This painting necessarily involves priming, which in itself, as applied to floors, is hygienic, as having the effect of closing the pores in which dust lodges, the dust, with its darkening and forbidding effect, never failing to find lodgment, unless, indeed, the boards should be of costly hard wood, which is the exception, not the rule. It may be said that a floor painted all over will not be seen; but without replying that a painted border where the whole area is not colored is a deception, we may remark that the entire treatment of a floor or cover affords a security against unsightliness should any portion of the central carpet be accidentally raised, and that in the event of its removal for purposes of cleaning, the painted floor suffices, more especially if enriched with a few rugs or tinted or patterned mats.

In the hot summer months a floor artistically painted will be often found preferable to carpet, as aiding in the movement of the air, not harboring dust, and proving on the whole cooler. Paint may be so compounded and laid on floors as to suffer but little injury, even when exposed, in a long course of time. Should the colors become dull, a slight varnishing will suffice to renew much of their pristine freshness. There are many rooms in a house which would be all the better for not being fully carpeted. Such especially are bedrooms. When we speak of painting a floor, we do not refer to giving it a uniform hue. The handsome designs carried out in encaustic tiles may be repeated in color. Geometrical figures centered with small leaf patterns are peculiarly appropriate; so, too, a host of fresco patterns, these being varied in successive tiers. Longitudinal lines representing the chromatic scale of colors might be repeated at certain intervals. Diagonal lines in different hues, lying athwart each other, in basket-work style, would have a good effect. The borders, as a matter of course, should be differently treated. —*California Architect.*

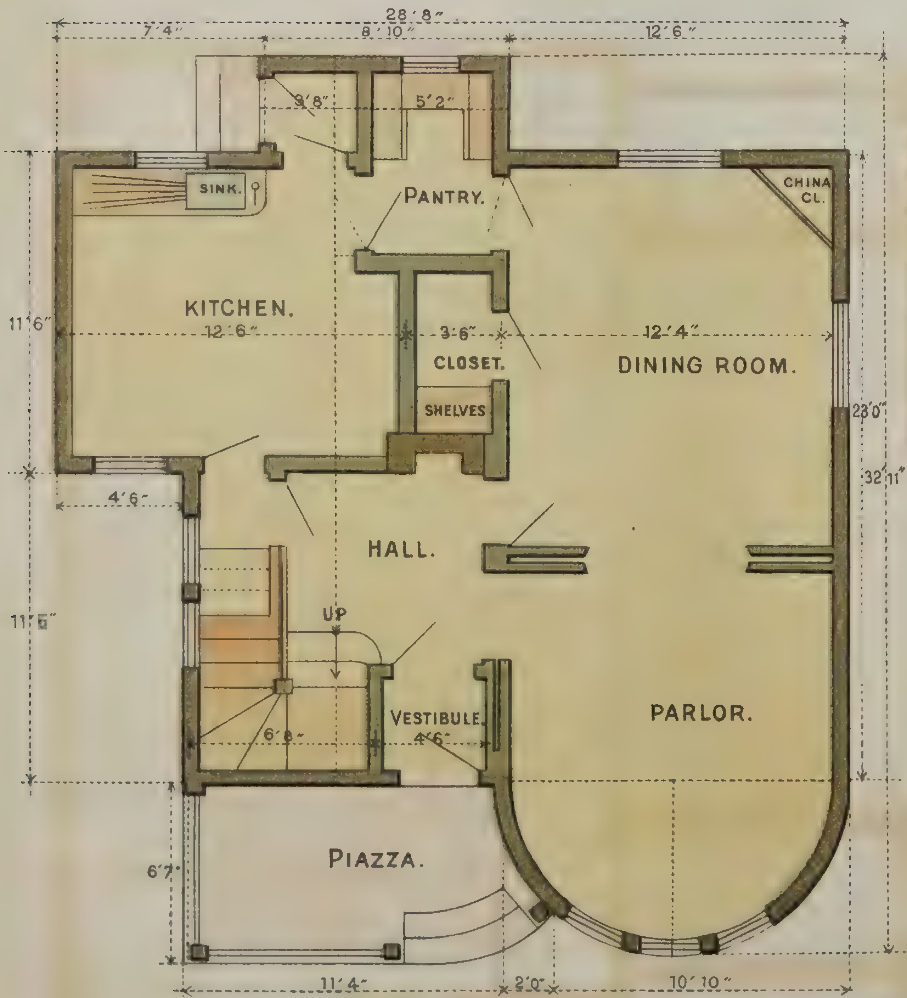
Relative Strength of Wet and Dry Timber.

In reply to a statement by the *American Miller* that "wet timber is not as strong as dry, in some cases it has not half the strength of dry," a correspondent of that paper writes as follows: "In September, 1876, the Lanesboro Mills, Lanesboro, Minn., burned, and that fall we rebuilt them and began making flour the next March. We used sawed pine (taken out of the Mississippi River) for joists, 3 in. × 12 in., 12 ft. long, and sized them, laying them on top of the girders to get their full strength, and then used ⅞ match flooring. The joists were placed 12 inches from center to center, leaving 9 inches between them. In the fall of 1877 we piled wheat on the floor 26 feet deep in the bins, and the joists, yet wet and green, only sagged a trifle, and carried the immense weight safely. Two years later the same joists were dry, from the heat of our very large stove. We loaded the floor with 24 feet of wheat, and six joists broke off nearly square in the middle, and others were cracked. In the first instance, the bins held 360 tons of wheat while the joists under them were green. When the joists were dry, 300 tons or less broke several of them. This shows that green pine is stronger than dry pine, as the wood becomes brash or brittle by drying, and is not as strong as when green. This is caused by the sap drying and leaving only solid matter in the capillary tubes, and they cannot move one on another, while if the timber is green the tubes are full of water, and can bend or move one on another. I know of but two kinds of wood that are stronger dry than green, and they are maple and white oak."

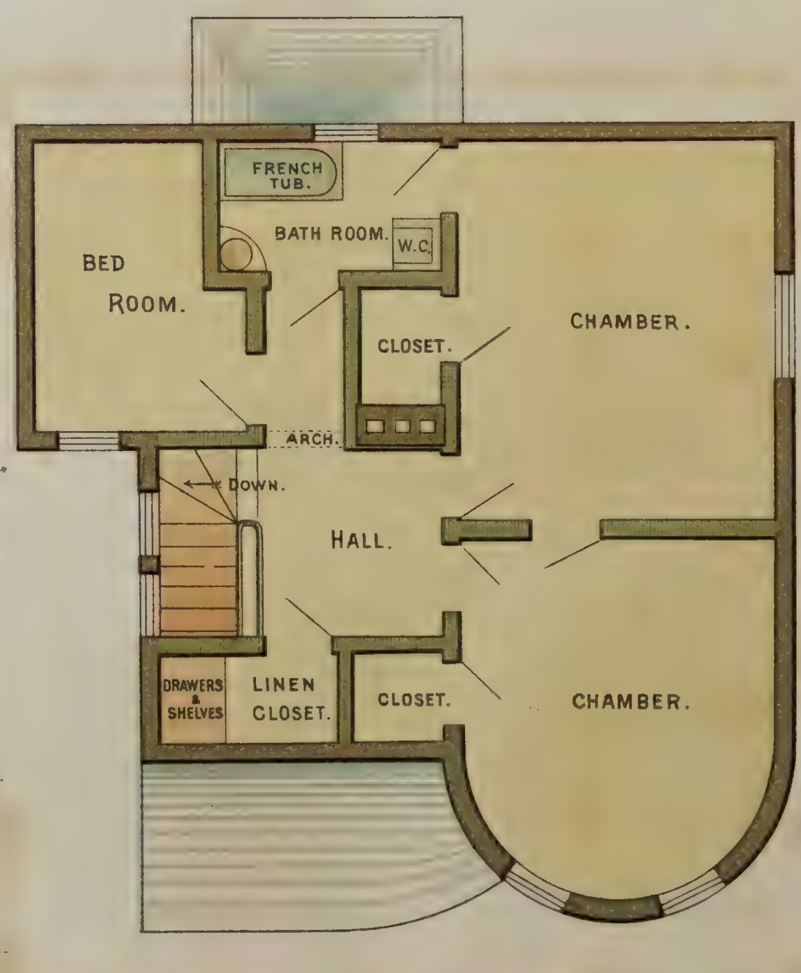
Lake Superior.

The largest body of fresh water on the globe is Lake Superior, 400 miles long, 160 wide at its greatest breadth, and having an area of 32,000 squares miles. Its mean depth is 900 ft., and its greatest depth is said to be about 200 fathoms, or 1,200 ft. Its surface is about 635 ft. above the sea level.

· A $ 2300 DWELLING · HARRY W. JONES, ARCHITECT, MINNEAPOLIS, MINN.

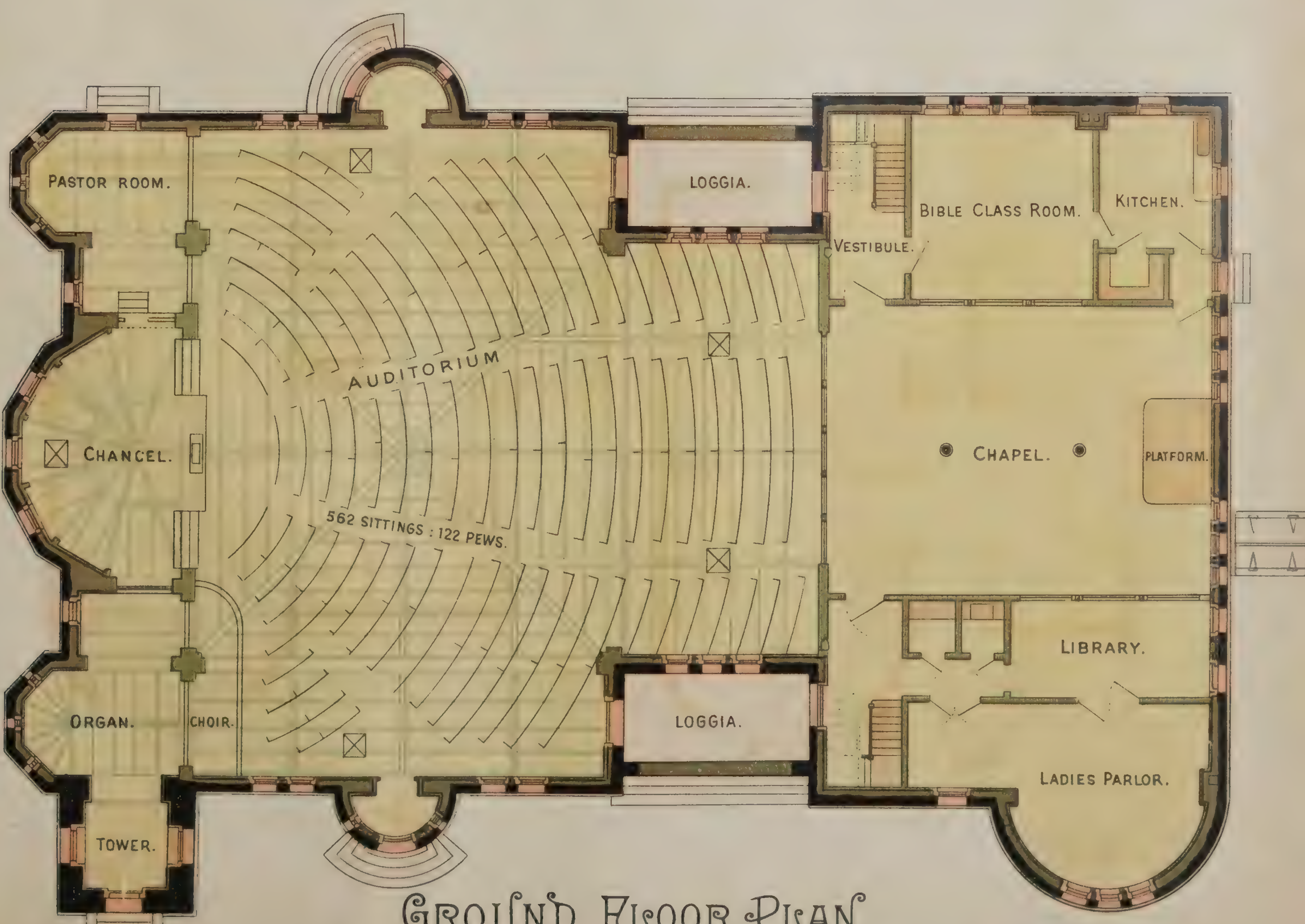


FIRST FLOOR PLAN.



SECOND FLOOR PLAN.

·A VILLAGE CHURCH· F. THORNTON MACAULAY, ARCHITECT, ELMIRA, N.Y.



GROUND FLOOR PLAN.
East Avenue Presbyterian Church.
SCHENECTADY, N.Y.

SCHUMACHER & ETTLINGER, NEW YORK

WINTER GARDEN WITH DETACHABLE WINDOW SASHES.

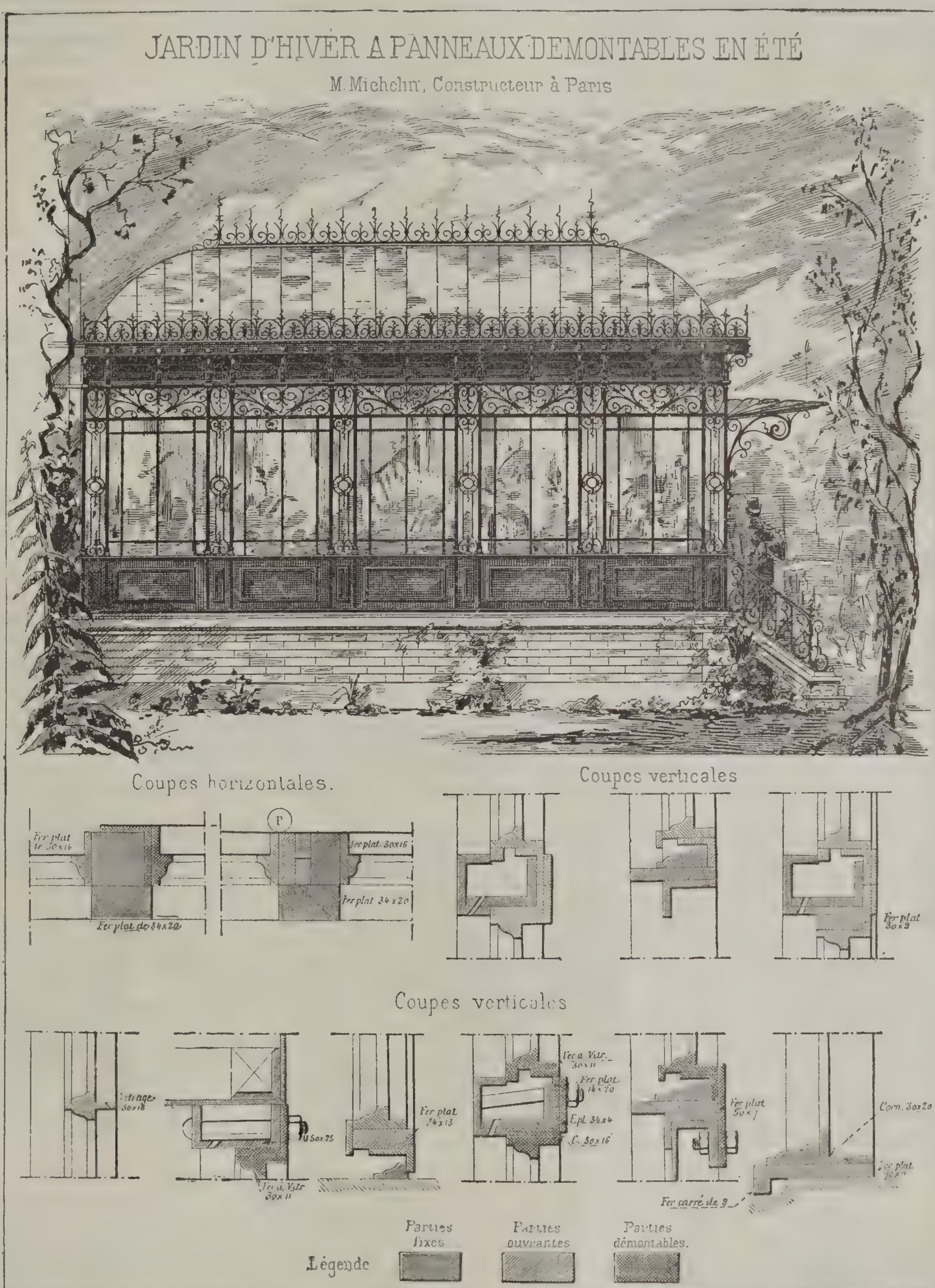
Our engraving represents a veranda which has been especially elaborated with the object in view of allowing of the conversion, in summer, of a perfectly closed, glazed housing, that the hot rays of the sun render uninhabitable, into a sort of pavilion, forming a perfectly aerated shelter.

The main frame and the entire ornamented portion of the structure are absolutely stationary, but all the panels and opening frames can be removed in such a manner that the ordinary aspect of the whole shall remain, and the air may circulate freely in all parts.

The horizontal and vertical sections figured at the bottom of the cut show the ingenious arrangements through which the builder, Mr. Michelin, has been enabled to reach this result. All the iron used is commercial, thus materially reducing the net cost.

Horizontal Section.—The section A is made through the two leaves of a folding window sash. The section B shows the point of attachment of a leaf to the jamb, formed by one of the pilaster uprights. Section C shows the assemblage of the upright that receives the angle iron of the detachable frame. At D is shown a section of the two leaves of the entry door.

Vertical Section of a Window.—Section G shows the arrangement of an impost rail running between the frieze of the opening glazed panels and the window cases. Section H shows the profile of a weather moulding formed of iron, and in front of which is riveted a flat iron drip. Section I shows, through the swinging door frames, nearly the same arrangement as section G for the window. At K is a section of the lower door rail. Finally, the vertical section of a frame gives, at L, a section of the rail beneath the gutter; at M, a section of the impost rail; at N and P, top and bottom sections of the iron plate of the sub-basement. It is to the interior arrises of these three rails, L, M, and N, that are affixed the angle iron frames, which are held in place during the winter season by bolts at the top and bottom.—*Le Genie Civil.*



WINTER GARDEN WITH DETACHABLE WINDOW SASHES.

Disposal of Hotel Sewage.

An esteemed correspondent who has recently passed some time at the Manhattan Beach Hotel, at Manhattan Beach, L. I., writes that the system of sewage disposal in operation there is very successful. He does not think any system could work any more satisfactorily than does this one, designed by Mr. J. J. Powers, a Brooklyn plumber. He says:

"The sewage (excreta and house water exclusively) flows by pipes (of such moderate size as to insure a speedy flow) into wooden water-tight tanks, where, by the use of such cheap material as charcoal and copperas, the whole mass, ninety per cent of which is water, is economically and thoroughly disinfected and deodorized, the solids being precipitated, while the liquids flow in a clear and harmless stream to the sea. The process works automatically and easily; there is no smell, even close to the settling tanks, and few of the hundreds of thousands who visit those wonderful caravansaries have any comprehension of how largely the welfare and business of the whole island depends upon this common sense invention of one clear-headed, fair-minded sanitarian. The solid portions of the sewage are disinfected and drained, and are removed as frequently as is necessary; the product (called native guano), a dark-colored poudrette, is used upon the lawns, and with magical effect, and when sold brings $20 dollars a ton."—*Sanitary News.*

German Middle Class Houses.

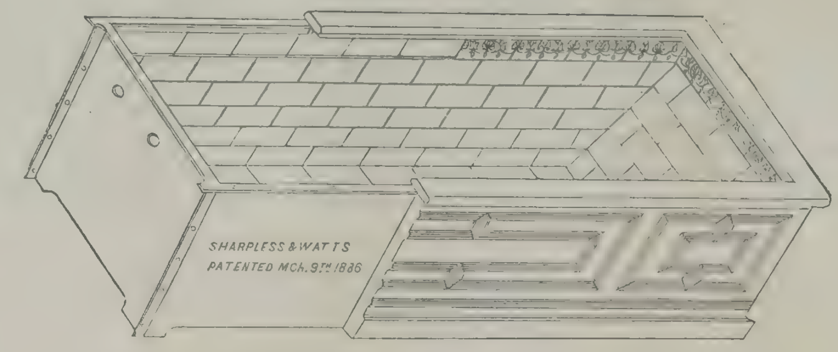
While sojourning recently in one of the German capitals, my attention was particularly called to the easy and simple manner in which the Germans live and keep house, as compared with that of our own people who dwell in rented houses in New York and other of the principal American cities, the difference arising particularly, I am persuaded, from the construction and arrangement of the dwellings themselves. I refer now to houses of that class of society who are neither rich nor poor—the so-called middle class—who usually, here in New York rent houses ranging from eight hundred dollars to fifteen hundred dollars per annum, but who seldom live in flats or own houses of their own. The reason that this class of people do not more generally live in flats or apartment houses is simply because few such buildings adapted to their necessities and means have yet been erected. But there is every reason to believe that many of their number, like some of the more wealthy, who can afford to pay three or four thousand dollars a year, would be very willing to exchange their three story, high stoop, and often ill constructed dwellings for apartments of an equal number of rooms, having the attributes of perfect light, ventilation, privacy, etc., at the same rent as they now pay, could such be had in New York. I believe that such apartment houses may be built, rented at eight hundred dollars to fifteen hundred dollars per suite, and allow the owner a handsome interest on his investment. Let us compare, briefly, the dwellings of this class in New York with those of the same class in the larger cities of Germany. Every one knows what the ordinary twenty foot, three story house is here, with its high stoop, brick or veneered brownstone front, uninviting basement dining-room, with kitchen back, narrow hall, and parlors in first story, with a repetition of the same hall and stairway in the second and third stories, and too often with defective plumbing and poisonous coal gas. The work required to keep such houses in order, not to mention the usual disadvantages of poor light and ventilation in the halls, is almost double that required by the German dwellings. There the houses are built free on all sides, are usually four stories in height, accommodating one family on each floor. The staircase is broad has windows at each landing, and every apartment has its individual entrance and bell. The buildings are ordinarily bout square, the main rooms grouped about a central hall, the kitchen and servants' bed-room being separated by an entry. All rooms are well lighted, have perfect ventilation, and, being on one floor, half the labor of housekeeping is avoided. I think it scarcely requires argument that such flats in New York, with the addition of the best modern plumbing and steam heating, which have not yet been introduced into the houses in Germany, would find ready occupants as fast as they could be erected. But until capitalists are assured of a fair return for the money invested, such buildings will not be built, as many even of those apartment houses where the suites rent from three to four thousand dollars have not been financial successes. However, I think to those having money to invest, apartment houses for just this middle class of people is a subject well worthy of consideration. They desire neither the luxury of a palace nor the shabbiness of a French flat, but as much room, and more light, air, ventilation, and comfort, than can be obtained in the ordinary twenty foot dwellings above referred to.

Take, for instance, a plot of ground 200 ft. square, that is, sixteen city lots, which, at $10,000 per lot, makes a total of $160,000 for the entire plot. This would allow of the houses being built in a desirable locality. Erect eight detached buildings, averaging 40×60 ft., and five stories high, so arranged that there is a space twelve feet wide between each two, a portion of which would be utilized for the stairways and elevators, which would be constructed wholly outside of the main walls of the buildings. Such structures, supplied with steam heat, the best of plumbing, neatly finished, and each and every room having direct access to the air, and, consequently, proper ventilation, would cost not to exceed $60,000 each, making a total for the eight of $480,000, and a grand total for the whole investment of $640,000. The entire structure could be planned to accommodate sixty families, at an average rental of $1,200, making a total of $72,000 as the gross receipts for all the apartments. Now, deduct $25,000 per annum for taxes, insurance, gas, coal, and wages of employes, etc., and we have $47,000 as the interest on an investment of $640,000, or a little more than seven per cent. The benefits derived by the occupants of such apartments would be, chiefly, perfect safety from fire, each floor being intact, as staircases and elevator wells are entirely outside of the buildings (there are no light shafts); the utmost privacy, as each has its own entrance and vestibule; perfect light and ventilation, and, on account of the arrangement of the rooms, the least possible care to the housekeeper; besides all of which, such steam heating, plumbing, and elevator service as are found in the most costly apartment houses in the city.—*J. R. H., in American Architect.*

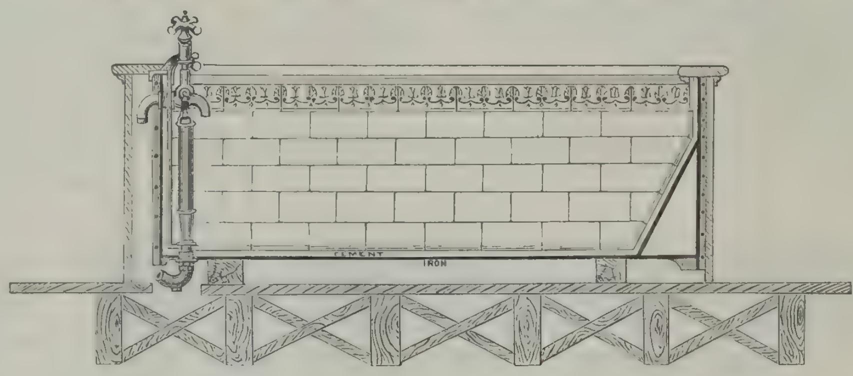
THERE is every prospect of a large output of lumber the coming season in Canada. The number of men being sent to the woods is greater than for some years past.

THE "IDEAL" BATH TUB.

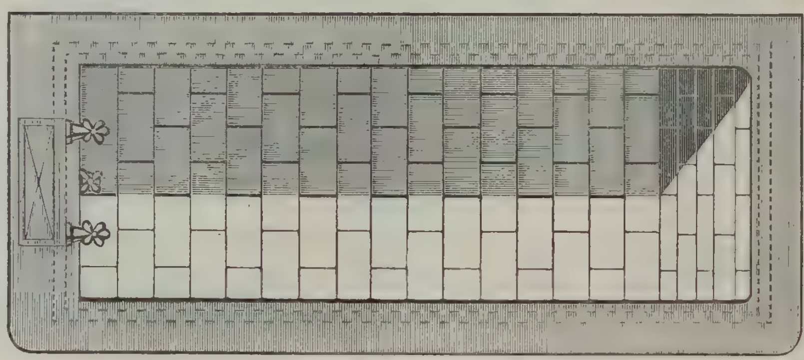
We herewith illustrate the new sanitary bath tub of Sharpless & Watts, 1524 Chestnut St., Philadelphia, Pa. It possesses the merit of extreme durability. The frame is of cast iron, securely fitted, the joints cemented and screwed together, thus preventing leakage. Upon the inner surface is placed a coating of Portland cement and glazed tiles, forming a perfectly water-tight compartment. The tiles admit of the most beautiful styles of decoration, the glazed surface of which, while preventing the adhesion of noxious particles or the retention of malarious odors, presents a clean and inviting surface. They may be inclosed in various ways, according to selection, either with a wood casing or the more elaborate and costly tiled exterior and marble capping.



SHOWING CONSTRUCTION OF FRAME WITH WOOD CASING.



SIDE VIEW AND SHOWING FIXTURES WITH PATENT OVERFLOW AND WASTE.



"IDEAL" BATH TUB.—TOP VIEW AND SHOWING DIMENSIONS OF WOOD CAPPING.

STABLES AND CATTLE HOUSES WITH HORIZONTAL FLOOR.

In our stables and cattle houses the excremental liquids may take two courses: they may either penetrate the earth through infiltration, and deposit therein the germs of contagious diseases, or they may be retained by the bedding, and cause the latter to quickly rot. In the latter case, the contact of this unwholesome and fetid material dirties the animals' coats, even if it does not injure their feet. In both cases, the greater part of the liquid is removed by way of evaporation. Hence, ammoniacal emanations, that grievously affect the organs of sight, and hence pestilential miasms that produce many an affection of the respiratory organs.

In order to overcome the grave inconveniences due to an unhealthy dampness and to the putrefaction of litter, the idea long ago occurred to have recourse to pavements, and to give this artificial ground a pronounced slope. Now, such a remedy is illusory, and, up to a certain point, worse than the disease. Illusory, because, notwithstanding a slope of say three-quarters of an inch to the foot, a number of small *cloacæ* form between the joints of the paving stones; worse than the disease, seeing that the slope of the floor exerts a most pernicious influence upon the economy of the animals. As especially regards the important question of perpendicularity and equilibrium, professionals say that a good and handsome horse, while at rest, should have his fore and hind canons exactly vertical. We shall see how contradictory the occupancy of a stable with sloping floor is to the conditions of natural statics.

Upon an inclined plane, like that of most stables, the horse necessarily assumes and keeps the attitude that he is obliged to take when going up hill. Now, in this forced position of continuous ascent, the entire weight of his body falls upon his shoulders and hind legs. The neck and shoulders descend, the nose points straight ahead, and the ligaments of the vertebral column pull upon the hind quarters. These latter, which have nothing to carry, stay, as it were, the fore quarters. But this function of a living brace is accomplished solely under the condition of a permanent contraction of the muscles, of an inclination of the hind quarters, and of a straining of the hocks. Moreover, every time the horse lifts his head toward the rack, we observe a straightening of the pasterns, for his toes are then seeking a holdfast. When, overcome with fatigue, the animal lies down upon this inclined plane, the weight of his body is thrown toward the rear. But then, under the action of such weight, the articulation of the haunch is again placed in a sloping direction; the head is kept depressed to secure an equilibrium; and the same pulling is exhibited in the lumbar region.

When it is a question of resuming an erect attitude, the horse must in the first place rise, through his fore quarters, upon a floor that slopes downward under his hind ones. To effect this motion, such an effort is required that it gives rise to numerous grave accidents, especially among breeding mares.

But let us suppose everything goes on well, let us see what fate is in store for the offspring. Let us see what happens after a while to a colt of good blood which has been obliged to remain permanently in a stable of which the floor has a decided slope. The head and shoulders, which, up to the moment of weaning, were high and well formed, become depressed and unshapely. Constantly loaded with the entire weight of the body, the shoulder becomes incrassated. Growth, which is arrested, or at least interfered with, in the fore quarters, first proceeds in the hind ones, as if to furnish a means of restoring the equilibrium on the sloping floor—an equilibrium absolutely contrary to nature. What happens when the animal comes to walk upon level ground? Its cruppers are higher than its withers. The muscles of the former have become abnormally developed, those of the leg have no longer any size or power, and the hocks, narrow and stiff, are devoid of play. As the hoofs have always been out of true in their point of support, the animal has become straight jointed in front and has worn out the points of its toes behind.

If the colt has much blood, if its fiber is dense enough to withstand the continuous action of the slope of the floor, it expends, during the course of this contest without respite, a portion of the food that ought to contribute to the work of its growth. The permanent fatigue to which it is submitted, in lieu of rest, is a cause of nervous superexcitation to it. Inflicted under such circumstances, stabling etiolates the animal, and the latter becomes lank and lean, and has a look of sadness in the face.

Upon the whole, it is to the bad arrangement of stable floors that must be attributed the faults in conformation, the defects in the limbs and joints, the early ruin of the extremities, the enfeebling of the energy, and the degeneracy of our racers. Fig. 1 shows a striking example of the sad results pointed out above. It represents the horse of a cavalry officer, an animal of good stock, but deformed under the influence of the floor of the stable in which it has terminated its growth.

What we have said of horses may be applied also to cattle. As usually built, stables and cattle houses are the worst enemies of all our domestic animals, equine, asinine, or bovine. While they affect the vigor of the horse, ass, and mule, the defects in the organization of the structures employed diminish the yield of meat in cattle, and sensibly reduce the amount of dairy products. It must be added that this justly criticised arrangement of the floor, to the detriment of agriculture, causes the loss of a large amount of nitrogenized liquids, that is to say, of principles that are essentially fertilizers.

In order to remedy this deplorable situation, Colonel Basserie recommends the exclusive adoption of a well drained, horizontal floor, such as shown in Fig. 2, which explains itself. As may be seen, the element of the system consists of a cast iron drain, set into a cement floor proof against infiltration. Attached to a flange at the side of the drain there is a cover which contains a concavity in the line of its axis narrower than the hoof of the smallest horse. This cover contains a series of apertures that can in no case get clogged up. This gutter allows liquids to reach the drain, and the latter, on account of its hinged cover, can be easily cleaned. The individual drains all connect with a main collector in the rear of the cattle or horses, and this leads to a trench designed for the storage of liquid manure. Such a system, which costs but little, offers inappreciable advantages. The first effect of its adoption is the suppression of the infection due to the imbibition or stagnation of the excremental liquids, as well as to the expansion of the ammoniacal gases derived therefrom. Hence, for the occupants, a suppression of the chief causes of epizootia. The animals, in fact, breathe pure air, and live under proper conditions of hygiene and cleanliness. The men whose business it is to look after them can then perform their duty without exposing themselves to the numerous affections which develop so rapidly in the atmosphere of unwholesome places. Moreover, the stable work is singularly simplified. In restoring the horizontality of the floor and securing the preservation of the bedding and the repose of the animals, the use of the Basserie system permits of preventing faults of

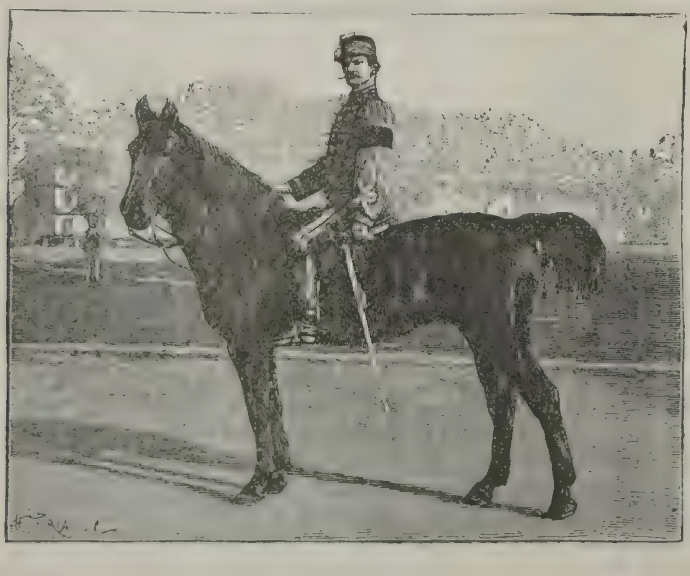


Fig. 1.—EFFECT OF A SLOPING STABLE FLOOR UPON A CAVALRY HORSE.

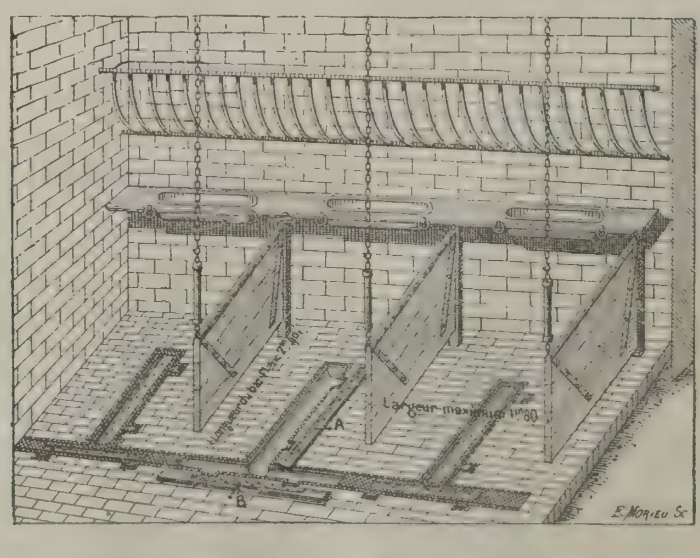


Fig. 2.—BASSERIE'S IMPROVED STABLE FLOOR.

conformation in breeding, defects in the limbs, and that useless fatigue due to a continuous attempt to obtain an equilibrium upon an inclined plane—a fatigue that is usually a prelude to early decay. The effect of the arrangement under consideration is to render the success of fecundation, gestation, and rearing infinitely more probable, the growth of the subject more rapid, and the production of the animal, either in work, meat, or dairy products, more remunerative. Finally, the nitrogenized liquids, collected without loss by the drains, can be used up to the very last drop in agriculture.

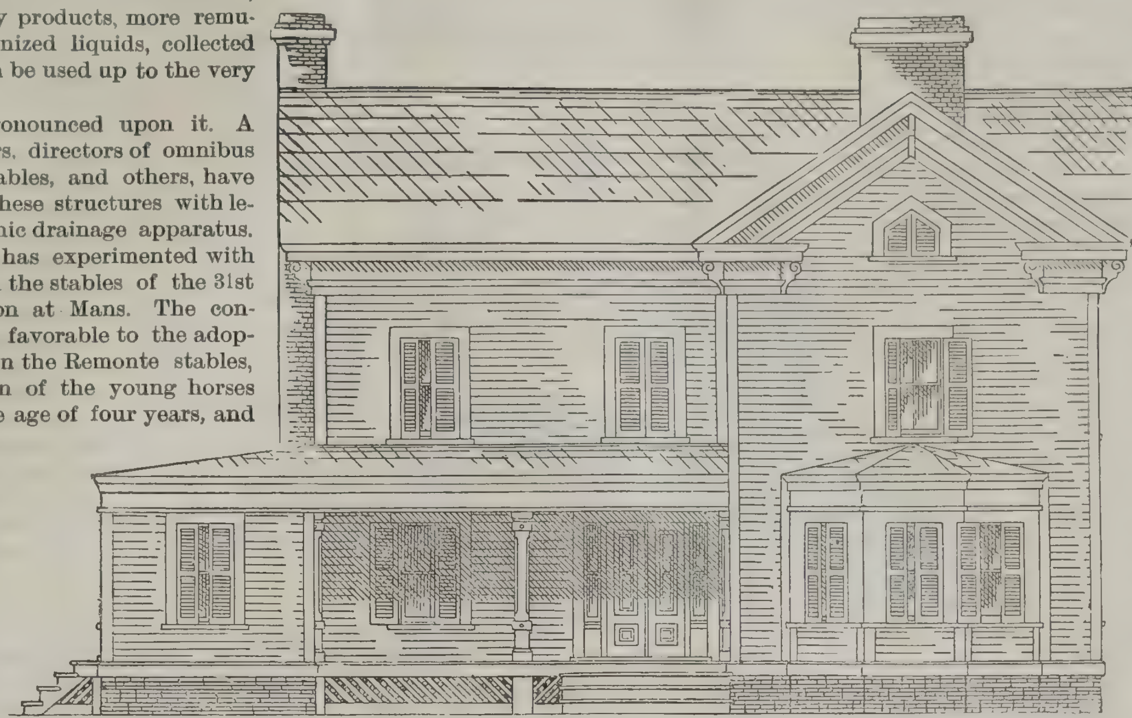
Experience has already pronounced upon it. A number of cultivators, breeders, directors of omnibus companies, owners of cow stables, and others, have recognized the excellence of these structures with level floors, provided with hygienic drainage apparatus. The war department likewise has experimented with the new system, particularly in the stables of the 31st regiment of artillery in garrison at Mans. The conclusions of the committee were favorable to the adoption of the system, especially in the Remonte stables, with a view to the preservation of the young horses that reach the regiments at the age of four years, and are not put in service until two years later.—*La Nature.*

AN ELEVEN ROOM HOUSE COSTING FROM $1,750 TO $2,000.

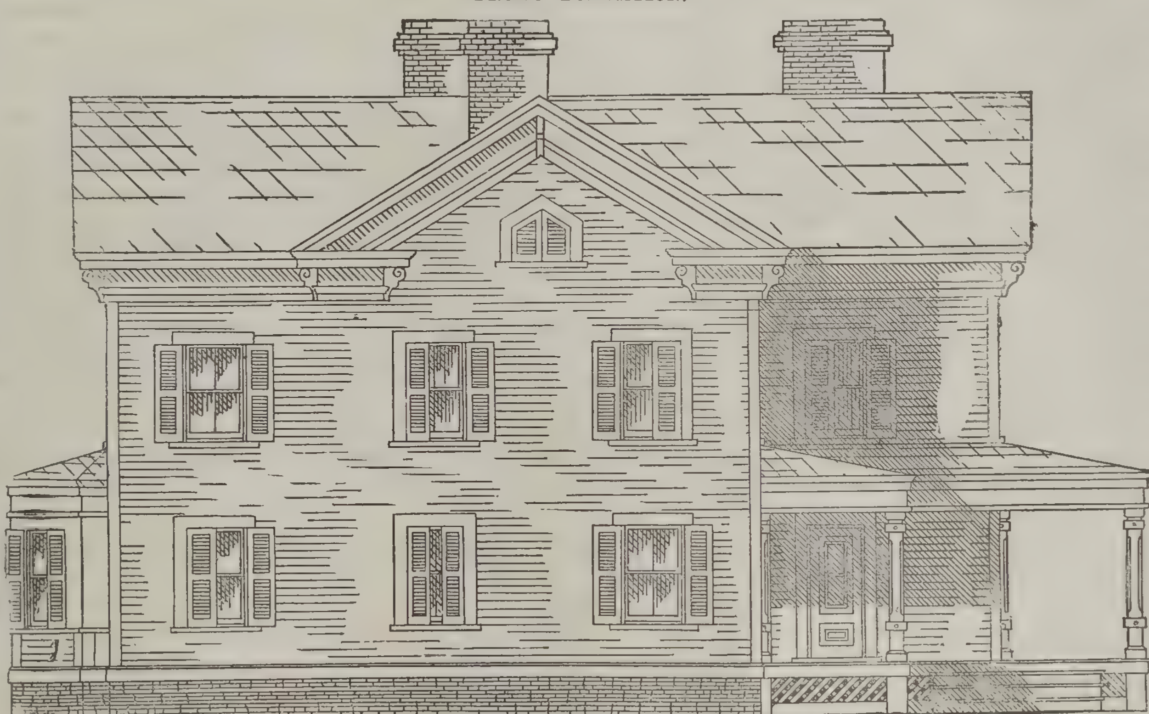
For the accommodation of a large family the house here described affords very liberal facilities, having on the second floor five sleeping rooms; and the library and children's room on the first floor are available for the same purpose, should occasion require. Upon a house of this plan a very large amount of money may be expended, if superior finish and costly material are used throughout; but the author of the design, Mr. J. A. Galbraith, of Greenville, East Tennessee, who proposed erecting this house for himself, computed the necessary outlay at so low a figure as $1,745.87. He says of it: "I have examined a great many designs and buildings, and this comes as near my ideal of a convenient and comfortable dwelling as anything I have seen for the cost. The prices will vary, of course, with the locality. We have no water works or gas, consequently I make no estimate for these. Brick would cost about 20 per cent. more here than frame."

In most localities, the cost of a frame house built from this plan would reach $2,000, even if economically put up; and if of brick, $2,500 would be a moderate estimate. If the cost of plumbing and gas fixtures be added, the figures would be still further increased. The height of the first story is 10 feet 3 inches in the clear, and of the second story 9 feet 3 inches. The cellar is under the dining room only, and is 12 by 12 feet, and 7 feet 6 inches deep. The foundation of the house is carried 2 feet above the ground.

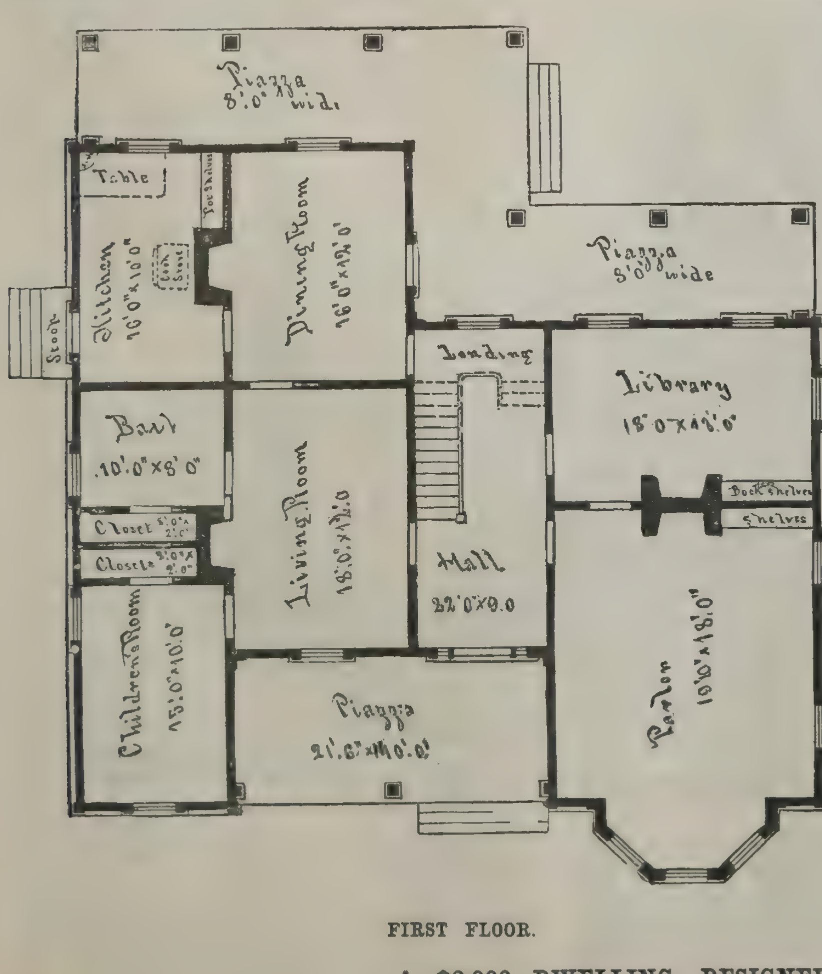
For a plain, spacious, and convenient house, where ground is abundant and cheap, and comfort rather than pretentious style is the object sought, this design will commend itself to a large class of readers. —*American Builder.*



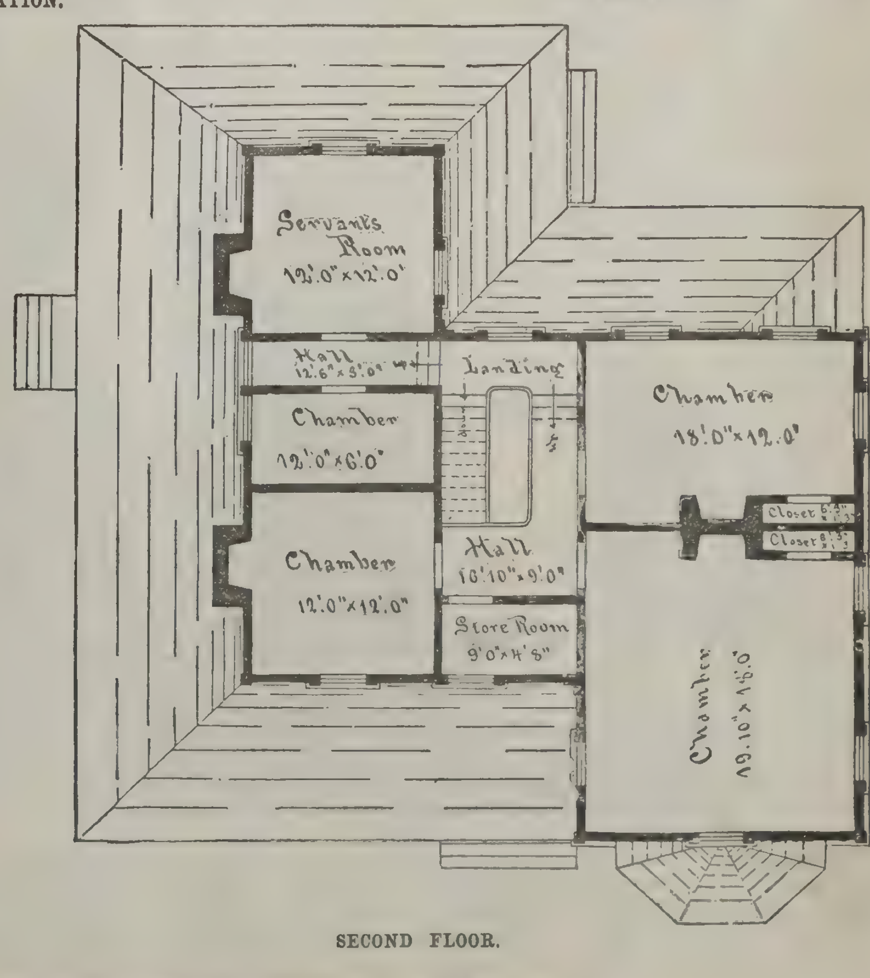
FRONT ELEVATION.



SIDE ELEVATION.



FIRST FLOOR.



SECOND FLOOR.

A $2,000 DWELLING.—DESIGNED BY J. A. GALBRAITH, GREENVILLE, TENN.

Spontaneous Combustion.

The subject of the spontaneous combustion of wood has been discussed at various times by the French Academy of Sciences. Among the most interesting statements made on these occasions is that by M. Cosson, describing an accident which occurred in his laboratory; it appearing that while he was working there, a portion of the boarding of the floor spontaneously took fire. The boards were in the vicinity of an air hole, fed with warm air from a stove about thirteen feet away on the floor below. A similar accident had occurred two years previously, and, in consequence, M. Gosson had the boards adjoining the air hole replaced by a slab of marble. The boards which subsequently ignited adjoined the marble; and though the heat to which the boards were subjected was very moderate, being only that of air at 77° F., still the boards slowly carbonized, and, being thus rendered extremely porous, a rapid absorption of the oxygen of the atmosphere had resulted, and sufficient heat was thus produced to originate combustion. A similar instance of spontaneous fire is said to have occurred at Passy a few days before, due to the action of the warmth from the air hole of a stove upon the woodwork, thus showing the danger liable to arise from this source, and the necessity of attention to the same on the part of builders.

IN Leominster, England, is a pair of trees, an oak and an ash, which appear to have but a single trunk. They grow together for about four feet, and then divide.

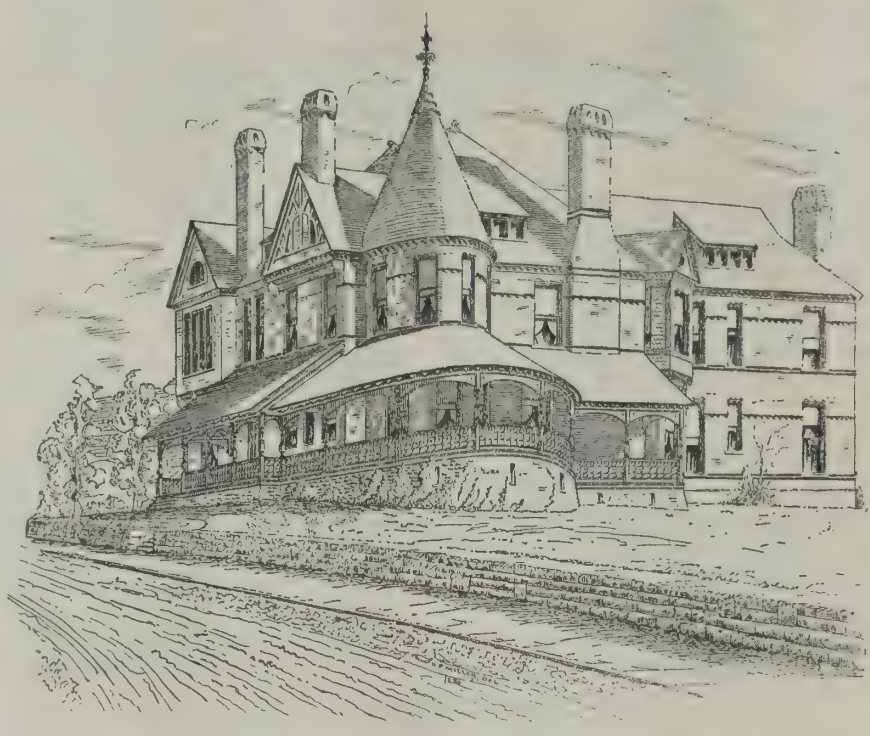
DWELLING AT UNIONTOWN, PA.

We give, from the *Sanitary News*, the design of a cottage building for Mr. R. H. Lindsey, from plans by Chas. M. Burns, architect, 717 Walnut Street, Philadelphia.

The foundation of massive stone is made to give a very picturesque effect on the sloping ground, which shows the first floor and the extensive circular balcony at a considerable elevation, making a pleasant promenade upon two fronts outlooking upon an extensive landscape. The first story is brick, relieved with belt courses of black brick. The second story is wood, with large roomy attic in the high shingled roof.

Turned columns or posts resting on a wall of rough stone support the ample porch roofs. Though hot air furnaces are used, open fireplaces are in the hall and on both first and second floors.

The interior finish is hard wood throughout. The architect has succeeded in bringing together in much harmony a number of popular features and styles, which we usually expect to find only brought into prominence where a number of buildings are called for. It is hardly safe for any but experienced artists to undertake so difficult a task.



A DWELLING AT UNIONTOWN, PA.—CHAS. M. BURNS, ARCHITECT.

How to Use Redwood.

While redwood is not a rival of cherry, mahogany, or oak for house finish, it is, says the *Lumberman*, a very good material for that purpose when properly finished. Most workmen at the East would probably treat the wood to a coat of oil at the first step. This is just what they should not do. The oil, with the aid of light and time, turns the wood a dark, dirty color, utterly devoid of beauty. No oil should be used, but instead the first treatment should be with white shellac of the best quality cut with alcohol; this to be followed by successive coats of white varnish, each well rubbed down. This finish will display and preserve the natural beauty of the wood, and will be lasting.

NEW POST OFFICE, LEXINGTON, KY.

For our drawing of this new public building we are indebted to the *American Architect*.

THERE has recently been completed at the Mechernicht Lead Works (Germany) a chimney shaft the height of which is probably unequaled in the world. Taking into account the eleven feet of substructure, the total height over all is 440 feet. The base is thirty-four feet square to a height of about thirty-four feet, where the shaft changes to octagonal, thence to circular, tapering to 11½ feet. The flue graduates from 11½ feet at bottom to 10 feet at top.

Model Tenement Houses.

In 1880 the Sanitary Reform Association of New York City devoted the sum of $300,000 to the erection of a model tenement, in which the occupants should be required to pay rent enough to return a fair interest upon the capital invested. The building occupies the easterly end of the block bounded by First and Second avenues, Seventy-first and Seventy-second streets, with a frontage of 200 feet on the avenue and 200 feet on the street. It is six stories high, and divided into apartments of from two to four rooms; the stairs are of slate, and the whole building is practically fire proof. Each apartment is provided with running water, private water-closet, and ashes are thrown into a chute, with openings at every floor. At the top of the building is a common laundry, each tenant having the use of a certain number of tubs for one day a week. In October, 1881, the apartments were offered to tenants, and almost all were occupied within a few months. A reading room, club room, bath rooms, etc., were opened as soon as the number of tenants grew large. The average rent per room was about $3 per month.

Nothwithstanding the enmity of tenement-house owners in the neighborhood and the strict rules concerning cleanliness, prompt payment of rent, etc., the demand for the apartments in this building has been most of the time greater than the supply during the last five years. Sometimes, as in May last, not one of the 218 apartments has been vacent, and only the least desirable rooms are ever vacant for more than a few days at a time. At present, the worst time of the year for tenement-house owners, eight apartments out of the 218 are empty. The investment has paid a steady yearly return of five per cent., and the property is today worth double what it cost in 1881, the neighborhood having become thickly settled since then, and unimproved real estate having more than doubled in value. The present rents range from $6.25 a month for two rooms to $14.50 for four rooms. There are no dark rooms in the buildings. The effect upon the neighborhood has been excellent. Landlords have had to offer more conveniences than formerly for the same rents, and to insist upon greater order and neatness in order to keep their best tenants.

Although the proprietors of this first model tenement have amply proved that decent buildings for poor people can be made to pay a fair interest upon the investment, few capitalists have been found to follow their example. Many building associations with ambitious plans have been organized, but have done nothing. The president of the Sanitary Reform Association, Mr. Cutting, is, however, so well satisfied with the working of the association's first tenement that he is about to put up another tenement upon the same plan further down town, and has bought for the purpose a plot of land, 116 by 88 feet, at the southwest corner of Avenue C and Fourteenth street, where work will begin in the fall. —*New York Evening Post.*

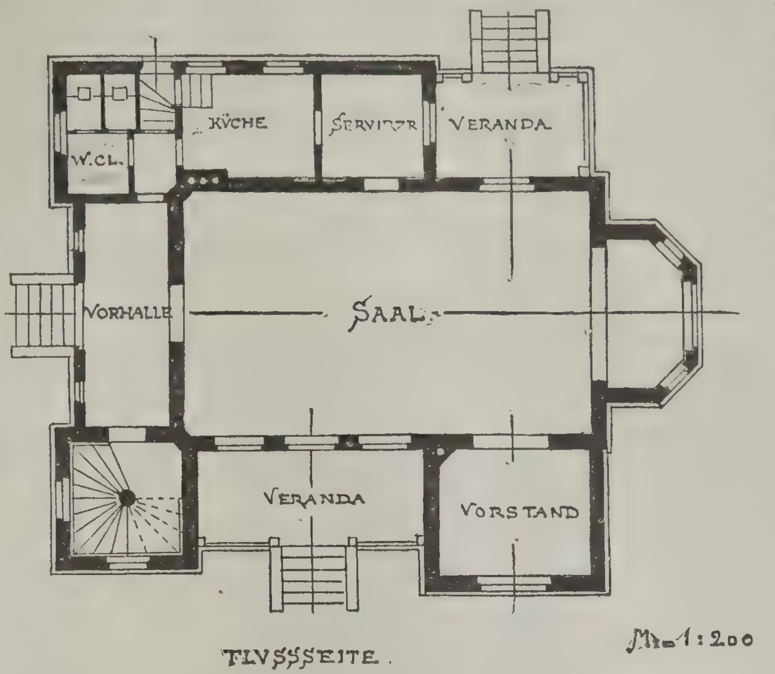
Capital Punishment by Electricity.

There is now being exhibited at Leipzig an apparatus for putting criminals to death by electricity. So long as it is found necessary to retain capital punishment upon our statute books, it may well be that the electric method is the most merciful and least repulsive process that could be devised for carrying the sentence into effect. In the Leipzig apparatus, behind the chair in which the condemned man is to take his seat—and by means of which, as we need not explain in detail, his body is placed in circuit with a powerful coil—there stands a conventional figure of Justice with bandaged eyes, holding the balance in her left hand and the sword in her right. The criminal having taken his seat, the proper functionary is supposed to read over the record of his crimes and the sentence of the law. This ceremony completed, he folds up the document and places it in the scale pan, the arm of the balance descends, closes the circuit, and all is over.

A CARRIAGE maker says a small piece of sheet zinc placed in the bottom of the glue pot will keep the glue sweet for an indefinite length of time.

CLUB HOUSE OF THE GERMANIA ROWING CLUB.

For our illustrations we are indebted to *Architektonische Rundschau.* The sleeping rooms for the men in training and the living rooms for the servants are on the upper floor, while the society hall and its annexes are on the ground floor. The cost of building was $5,760.



A Convenient Cow Stable.

What comfort there is to the milker (and the cows as well) in a good stable! My cows stand in their stalls twenty hours out of the twenty-four; and yet they have not a stain or tag on them. My stable is warm, well lighted and ventilated, and so arranged as to get the feed to the cattle and clean out the manure and waste from the fodder with the least possible labor. The floor on which the cows stand is exactly five feet long, and about ten inches lower than the manger or feed floor from which they eat hay and fodder. A board a foot wide is nailed edgewise to prevent the cows from pulling the hay or fodder under foot, and feed boxes fourteen inches square are notched down four inches into this board and securely nailed against the partitions between the stalls. This leaves the bottom of the feed box eight inches above the floor of the manger and gives room to sweep under it, which is an advantage. I find also that, having the feed boxes at this height, the cows very rarely spill any meal over. In my old stable the boxes were set flat on the floor of the manger, and this floor was on a level with the one the cows stood on; and a cow would fill her mouth with meal, then raise her head to chew it, and the waste would fall over the box. I think each cow wasted nearly a pint a day. Then the wet chaff and hay seed was always gathering and caking in the corners next to the box, and in a very few years the floor was rotted through. The floor of my manger is laid with matched pine boards running lengthwise, and every morning I sweep it perfectly clean. It is thirty feet long and five feet wide (there being a row of stalls each side), but I can sweep it in less than a minute. Behind the cows is the manure ditch, exactly two feet wide and eight inches deep, and the end of this ditch comes right to the center of the stable door, so that the cows walk into the stable through the ditch until they come opposite their stalls, and then step up on to the floor. In cleaning the stable we also run the wheelbarrow in the manure ditch. The ditch is water tight, the edges are made of two inch plank, and there is eight inches of yellow clay pounded into the bottom of it, and a board floor is laid on this clay, with, of course, short joists across for the boards to sit upon. On these boards the shovel slides easily along in cleaning out the ditch. Back of the manure ditch is a raised floor two feet wide, and on a level with the floor the cows stand, and this we use as a walk to pass in behind the cows. This walk is floored with boards cut two feet long and nailed at the ditch end to the two inch plank which forms one side of the ditch. This ditch will hold the manure from the cows for four days, when we bed with sawdust, but the stable will be much sweeter to clean it every day, and we make this our practice, and after cleaning it always scatter a little fresh sawdust in the ditch as well as on the floor. Occasionally a cow, by turning a little angling in her stall, will drop some manure on the floor, and so I keep hanging right behind the cow a hoe, and always when I enter the stable, if there is any dung lodged on the floor, scrape it into the ditch.

The partitions between the cows do not extend back to the manure ditch, as they would be in the way about milking, but are three feet long. Thus, while they prevent the cows from interfering with one another, they do not trouble the milker Back of the walk is a root cellar, 14×15 feet, in which we can store about one thousand bushels. The other part of the stable is divided into two box stalls, each seven feet wide, and one of these we can use for storing bedding, and sawdust can be thrown into it through a chute directly from the wagon when in the wagon shed, and through another chute our root cellar is filled.

One of the greatest conveniences about my stables is the ease with which hay and fodder can be fed. The cows stand directly under the barn floor, which is 14×30 feet. On one side of the floor is a bay filled with hay, and on the other side a bay of corn fodder. The floor to the bay in front of the cows stops just two feet from the barn floor, and boards are leaned at an angle and rest against a nail tie three and a half feet above the barn floor. A board six inches wide is nailed at the bottom to prevent the chaff and dust being thrown down, and either hay or fodder drops directly in front of the cows, so that it need not be moved at all. I feed hay once a day, and fodder twice. Part of the time we cut our fodder in lengths of about eight inches, and when we do the waste is used for bedding; but when fed long, we open the door at the end of our feed room and carry the waste out into the barnyard and scatter it over the manure pile. I have written something about this stable before, but I have no apology to offer for introducing the subject again, for not one farmer in ten has a cow stable so arranged as to enable him to keep the cows clean and feed conveniently, and yet a small expense would in most cases enable them to rearrange their stables so as to greatly improve them. It only takes forty feet of inch lumber to lay a double floor for a cow stall, and two or three days' work will make over a stable large enough for six or eight cows; and the work can be done rainy days in winter, when nothing else can be done profitably.—*National Stockman.*

Provide for Your Own.

There are those who decline to take insurance on their lives, and others who oppose the business on the theory that it is speculating on human life, or an interference with matters which we should be content to leave with our Heavenly Father. Of course, such feelings and expressions are the result of superstition or prejudice. Life insurance provides the means of protection which no other institution gives. The same arguments which would prevent us from using its beneficent influence would also prevent our doing many other things which God has provided us the means of doing. The good book tells us that "he who provides not for his own household is worse than an infidel." No command is given as to how that provision shall be made, beyond the teaching that honesty and conscientious practice should prevail. Life insurance gives every man of moderate income the opportunity of providing a patrimony for those who come after him. To neglect that important duty is a failure to comply with the divine command to provide for one's own. To invest in a policy on one's life is no more of a speculation or bet than to hazard the chances of not living, which, without insurance, leaves the family, in case of death, to the mercy of others.

Having decided to take insurance upon your life, it is of the utmost importance that a wise selection of company is made. One of the first considerations should be that of financial strength. It is always cheaper to procure life insurance from an old established company than from one with little or no experience and with less resoures. Had more care been exercised a few years since, when so many mushroom concerns sprang up only to disappoint those who put confidence in them, the losses in life insurance by failure would have been merely nominal.

Everything considered, no company offers greater advantages than the Ætna Life Insurance Company, of Hartford, Conn. It has over thirty-six years of successful experience; its assets exceed $30,000,000; its surplus, after providing for its liabilities, as required by law, exceeds $6,000,000.

The Ætna is favorably known and freely patronized. It enjoys the reputation of being conservative yet active in its management. It gives one of the best forms of contract issued, and pays its claims promptly. The Ætna gives every form of policy in general use, and the best possible results under them. For further information, address the company or any of its agents.

THE GERMANIA ROWING CLUB HOUSE FRANKFORT ON THE MAIN.—ALFRED GUNTHER, ARCHITECT.

The Moral Influence of House Ownership.

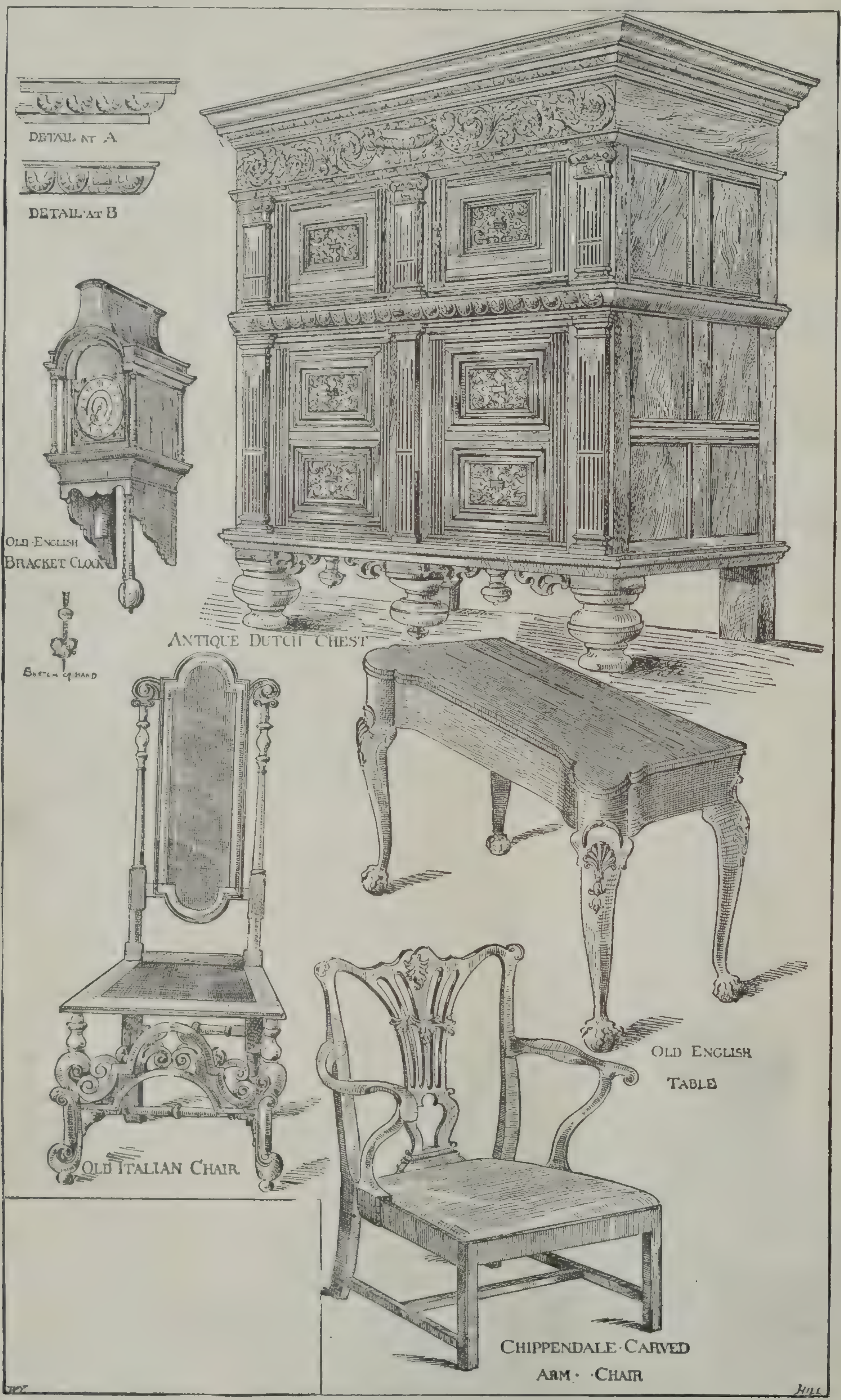
B. F. Northrop, in the *Age of Steel*, makes the following remarks on the moral influence of house ownership:

"Philadelphia, as the greatest workshop of America, furnishes a striking illustration in point. Its comparative exemption from strikes is due to the fact that, as a rule, the workingman there owns his home. Hence, he is as conservative as the capitalist. You may find scores of squares with nice brick houses of workingmen, not one of which is a tenement house. Philadelphia now has double the number of dwelling houses of any other city of its size in the world. This marvelous increase in its homesteads is due to its co-operative building associations, numbering over four hundred. They have been tried for nearly fifty years, and have proved such valuable forces in promoting industry, economy, sobriety, thrift, and prosperity, that the State encourages them by exempting all their stock and mortgages from taxation. Though the holdings of these associations exceed $50,000,000, they are managed by workingmen at little expense, and are always open to public scrutiny. Failures have been very rare, less than in any other class of financial associations. The worst of those closed during the panic of 1873 paid ninety-three cents on the dollar. These associations, so unique, tried so long and so successfully, are a model for the workingmen of the country, certainly in large manufacturing centers.

"That I may speak authoritatively, I will epitomize certain statements kindly furnished me by an eminent Philadelphian, especially conversant with this subject, who says: 'The tenement house is unknown here. In the riots of 1877 the 20,000 members of building associations acted as an efficient counterpoise to the lawless throngs that crowded the streets. The instinct of self-preservation, of social order, was as strong with them as with the wealthier classes, and was even more effectual. It neutralized, in their own camp, the clamors of a vicious and riotous rabble, so that the presence of the mayor and the police was sufficient to quell all disorder without collision. These associations have been a potent factor in making our people prosperous and moral, encouraging sobriety, and preventing dissipation. The absence of any socialistic tendencies can undoubtedly be traced to the general ownership of homes.'"

OLD FURNITURE.

We give illustrations of several pieces of old furniture which have been much admired in London at the establishment of Jenks & Woods, Holborn Viaduct. The large oak chest is Flemish seventeenth century, richly paneled, carved, and inlaid with ebony. The old table has a folding top and carved cabriole legs. The Chippendale elbow chair is a very good specimen of the best period. The bracket clock is also a very good example, similar in design to the old Dutch clocks, but better made; it has only one hand, that pointing the hour. The Italian chair is well carved. It has a cane seat and back.



OLD FURNITURE.

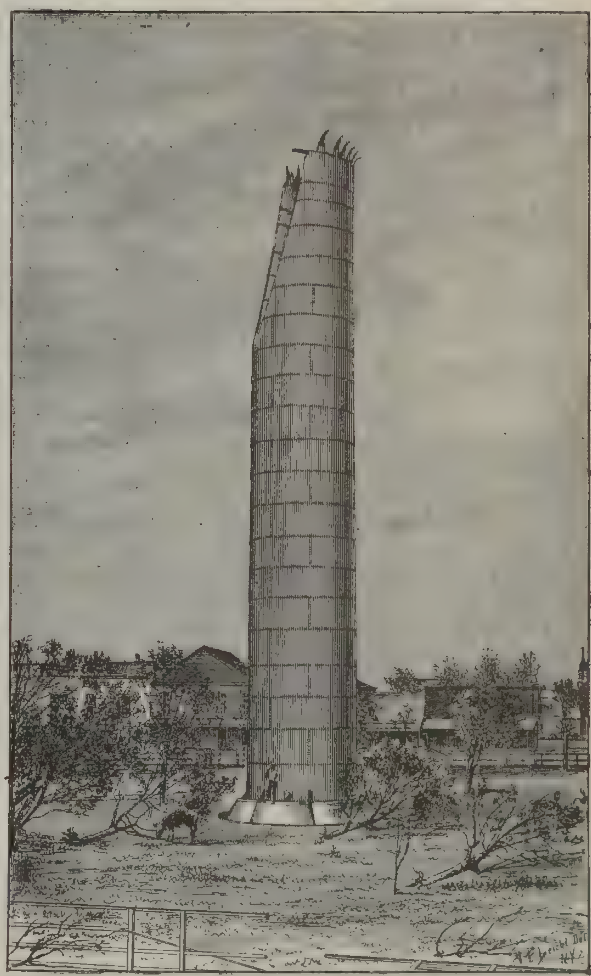
THE new steamer City of Brocton made her first trip from Fall River recently, and will now take her place in the Fall River line for Boston and the East. She is 290 feet long, and will be used exclusively in the freight service. Her capacity is 100 car loads.

THE WATER TOWER AT VICTORIA, TEXAS.

We are indebted to Mr. R. W. Stayton, of Victoria, Texas, for photographs of the water tower at that place, together with the following interesting particulars of its partial collapse:

"On the 20th of August this place was visited by a very severe cyclone, the wind reaching the velocity of about 80 miles per hour. We have a system of waterworks with a reservoir or standpipe 16 feet in diameter and 100 feet in height; the iron is one-half inch thick for the first 70 feet and three-sixteenths inch the remaining 30 feet. This pipe was erected with all the care and skill used in the construction of a steam boiler. During the storm this pipe was swayed to and fro, and the sides swerved in and out like some huge animal striving for breath, and finally collapsed as you see it in accompanying picture. The question among some of us is whether this collapse was induced or caused by the vibration or by the creation of a partial vacuum from the violent wind passing over the top exhausting the air within, having nothing within to withstand the outer pressure, there being only 70 feet of water in the pipe at the time. I claim that the collapse was caused by the wind creating a partial vacuum, and others claim that it was caused by vibration alone. The upper edge of pipe, just where the points of iron are riveted on, is re-enforced by a heavy angle iron. I send you three different views of the standpipe."

In reply to our correspondent, we would say: The



THE WATER TOWER AT VICTORIA, TEXAS.

collapse of the standpipe seems to have been on the side from which the greatest pressure of wind occurred, as by inspection of the photograph the trees near the standpipe, which were probably overthrown at the same time as the collapse, all lie in one direction, and that coincident with the direction of compression in the standpipe. From our inspection, the tornado was not central over the standpipe, but far enough on one side to give it the full force of its gyration. This in our opinion precludes the possibility of a vacuum being the cause of the collapse.

The thinness of the iron, three-sixteenths inch, and its great proportional area exposed to the force of the wind, will no doubt readily account for its swaying, buckling, and final collapse, if we only take into consideration the force of the wind in pounds per square foot of exposed area.

Tornado winds blow at a rate of from 90 to 100 miles per hour, and exert a force of from 40 to 60 pounds per square foot of area.

The mean area exposed above the water line, all of only three-sixteenths inch iron, may safely be taken at 300 square feet, which at 40 pounds per foot would amount to 12,000 pounds, or 6 net tons pressure on the windward side, with no support on the inside; while the leeward side was supported in tension by the small partial vacuum of a lee wind, which is equal to the slight vacuum or draught caused by blowing across an orifice, as the other parties claim. We are confident that lateral pressure caused the collapse of the standpipe.

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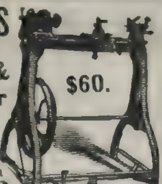

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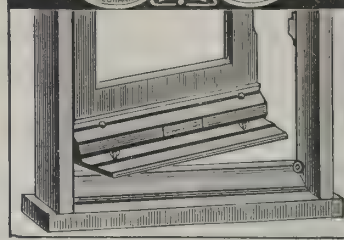

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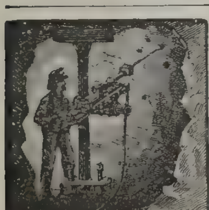

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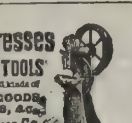

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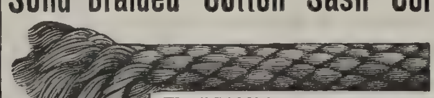

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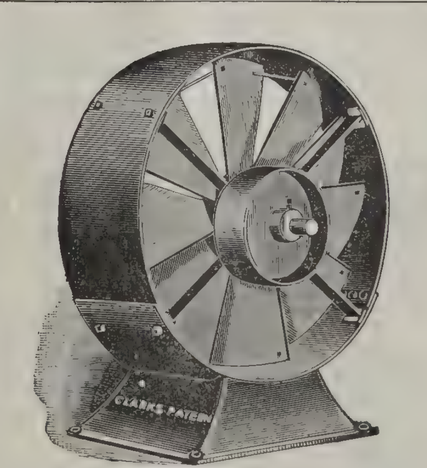

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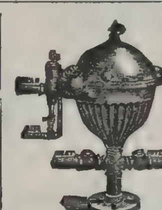

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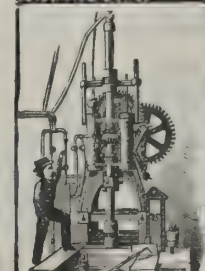

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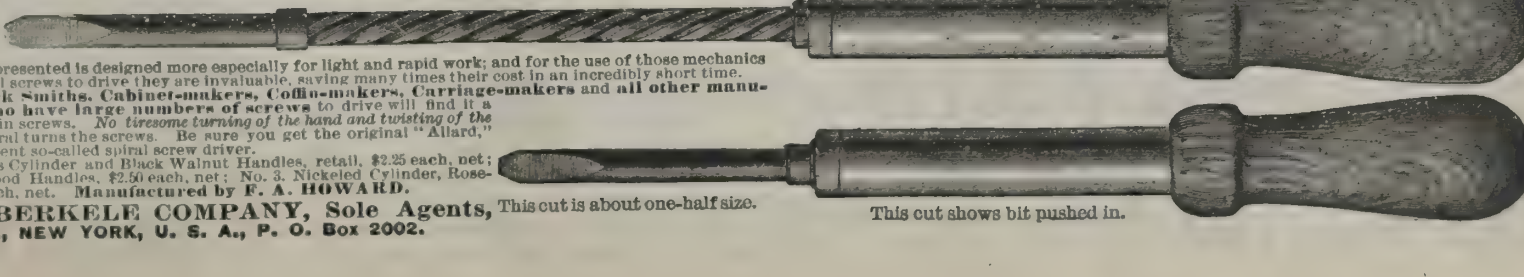

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Notes & Queries

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Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
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Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) W. W. A. asks: Will you please give a formula for making concrete and asphaltum for walks? The probable cost of each per square yard? A. Procure bitumen (asphaltum), boil and mix with it dry, common limestone or even broken bricks, which should be ground small and stirred into the boiling asphaltum, 4 parts stone to 1 of bitumen. When thoroughly mixed, pour out upon the ground, confining the edges with boards, spread it smoothly with heated iron roller, sprinkle with sand over all. Sand and gravel are not as suitable for the preparation as calcareous substances, as they do not have as much affinity for the bitumen, and the mixture cracks in consequence. For cement walks for first coat use 1 part Rosendale cement and 2 parts coarse gravel. Second or upper coat, 1 part of the cement and 2 parts clean sand. The cost depends upon the price of materials, thickness laid, and wages paid for labor.

(2) M. A. writes: 1. I want to build a water-tight privy vault. Can use gravel, split stones, cobbles, etc. Please state best materials, the kind of cement, and directions for building the vault. A. The best way is to wall up the sides of excavation with brick laid on the edge. For the bottom use concrete (cement, gravel, and small stones). Plaster sides with Rosendale cement to make vault water-tight. The excavation should be at least 6 feet deep. 2. Give dimensions, material, and directions for making a high flying kite of medium size. A. As to kite, cross upright stick, 3 feet long; horizontal stick, 2½ feet long; spruce wood. Take a common lath of straight grain and trim it down so that it may be as light as possible and not impair strength. Fasten securely together and bind a string around ends, and cover with light manila paper. Properly adjust the belly band and suspend a tail of cotton or woolen rags, just long and heavy enough to prevent diving.

(3) E. H. R.—Stained floors are often varnished with two coats of oak or copal varnish. To polish a floor, first carefully stop all nail holes and cracks, and then apply hot melted wax with a large brush, taking care to get it well into the wood, brushing the way of the grain. On the following day, polish the floor with hard hair brushes, which may be attached by straps to the feet of the polisher. If the floor is not yet stained, you can do it by mixing with the wax about one-fourth part of annatto and a small quantity of Vandyke brown and burnt sienna ground in water, varying the quantity with the depth of color required.

(4) W. H. R. says: Two years ago we built a school on a gravel and sand soil, with a grouted and cemented basement floor. The timbers in the basement, which were neither oiled nor painted, now show signs of dry rot. Please suggest a remedy. A. The only sure means of effecting a cure for dry rot is to remove the cause, which, in most cases, is a want of ventilation. Having promoted a draught with the outer air, remove every particle of the timber affected and replace with new of sound and well seasoned quality. Then give the whole three coats of the following mixture: oil of cassia, wood tar, and common train oil, mixed in equal proportions. Dry rot is highly contagious, and the success of the operation will depend upon the total removal of the affected timber.

(5) E. L. C. V. desires (1) a recipe for a furniture (walnut and ebonized) polish not varnish. A. Mix thoroughly olive oil 1 pound, refined oil of amber 1 pound, and tincture of henna 1 ounce. Keep the mixture in a well stoppered glass bottle. Apply with a tuft of raw cotton and rub dry with a cotton rag. 2. What can be used to clean fly specks from lacquered brass work (chandeliers) without injury to the luster? A. Old ale is a good thing to wash any gilding with, as it acts at once on the fly dirt. Apply it with a soft rag.

(6) G. S. H. asks how to laundry shirts to give the fine gloss to the bosoms. A. Take of white wax 1 ounce, spermaceti 2 ounces, melt them together with a gentle heat. When you have prepared a sufficient amount of starch, in the usual way, for a dozen pieces, put into it a piece of the polish about the size of a large pea; using more or less, according to large or small washings. Or thick gum solution (made by pouring boiling water upon gum arabic) may be used. One tablespoon to a pint of starch gives clothes a beautiful gloss.

(7) A. W. asks: 1. How can I remove paints from the floor of a room that has been used for a store room for the sale of paints? A. Take 1 pound American pearlash, 3 pounds quick stone lime, slake the lime in water, then add the pearlash, and make the whole about the consistence of paint. Lay the mixture over the whole body of the work which is required to be cleaned, with an old brush; let it remain for 12 or 14 hours, when the paint can be easily scraped off.

(8) H. J. C. desires (1) a receipt for frost-proof ink. A. Aniline black 1 drachm, rub with a mixture of concentrated hydrochloric acid 1 drachm, pure alcohol 10 ounces. The deep blue solution obtained is diluted with a hot solution of concentrated glycerin 1½ drachms, in 4 ounces of water. This ink does not injure steel pens, is unaffected by concentrated mineral acids or strong alkalies, and will not freeze at a temperature of 22 or 24 degrees below zero. 2. A receipt for liquid glue made without acid. A. An excellent liquid glue is made thus: Take of best white glue 16 ounces, white lead dry 4 ounces, rain water 2 pints, alcohol 4 ounces. With constant stirring dissolve the glue and mix the lead in the water by means of a water bath. Add the alcohol, and continue the heat for a few minutes. Lastly pour into bottles while it is still hot.

(9) J. W. V. asks what material potters use to give a gloss or polish to their wares, something in the shape of a powder placed in their furnaces. A. Doubtless you refer to the salt glaze, which consists simply in throwing dry salt into the furnace while the articles are being baked. Other glazes are produced by dipping the articles into a specially prepared mixture, substantially glass ground into fine powder and suspended in water, receipts for which can be found in any of the works on pottery.

(10) K. B.—We know of no better way of cutting marble than that practiced by the marble sawing trade. Make your saw of thin sheet iron, no teeth, size of a common wood saw, and fit it into a wood saw frame and work the saw forward and back on the marble, with fine sharp siliceous sand and water, plenty of each. It is slow work, but the best we can do.

(11) Z. R. B. desires a few hints on permanently staining in different colors a polished white marble mantel piece. A. Marble may be stained or dyed of various colors by applying the solutions mentioned below to the stone, made sufficiently hot so that the liquid will just simmer on the surface. Blue, tincture of litmus; brown, tincture of logwood; crimson, a solution of alkanet root in oil of turpentine; green, tincture of sap green; red, tincture of dragon's blood or cochineal; yellow, tincture of gamboge or turmeric. Success in the application of the colors requires considerable experience.

(12) W. T. T. says: Please oblige an old subscriber with the receipt to prevent awnings and cotton goods from mildewing. Also a receipt to make tents waterproof. A. 1. Use 4 oz. powdered alum and 4½ oz. sugar of lead, dissolved in 3 gals. water. When perfect subsidence has taken place, pour off the clear liquid only, and add to it 2 dr. isinglass, previously dissolved in warm water, taking care to mix thoroughly. Steep the goods well, and dry without wringing. 2. In 80 parts of water heated to about 80° C. melt 3 parts of gelatine and 6 of castor oil soap; then add 3 parts gum lac, stirring the liquid until entirely dissolved. Withdraw from the fire, and add to the mixture, little by little, 6 parts of powdered alum, stirring all the while. The liquid thickens in forming an insoluble alum soap, which is intimately incorporated with the gelatine and the gum lac. Spread it over the stuff with a bristle brush.

(13) W. C.—A good way to line a long shaft by the boxes is to set up a true carpenter's level, on a couple of light yokes or frames nailed to the beams, so that the top of the level will be at the proper level of the center of the shaft. Cut a cardboard disk the size of the shaft and place in the box of the end hanger and adjust the hanger to the sight range across the level, then adjust the hanger at the other end in the same manner. The end hangers being on a level and in their proper horizontal position, all other hangers may be readily adjusted by a sight range through the boxes. A stretched line is proper for horizontal adjustment. The spirit level adjustment along a line of shafting already in place is proper, but rather tedious. A set of 3 or 4 hooks to hang on the shaft, all of exactly the same length and projecting below the pulleys, one at each end, the others moved along to different sections of the shaft, with a line sight along their ends, is a quick way of bring each section to its proper level. A line shaft may be connected to the engine shaft with a flexible link with propriety, where there is requirement for such connection and the line shaft is subject to flexure.

(14) H. L. F. desires (1) a recipe for a compound that will harden wood, preventing it from splitting or cracking. A. Wood steeped in a solution of iron sulphate or copperas becomes very hard and almost indestructible. 2. What will permanently and without injury remove superfluous hairs on a lady's face? A. There are numerous depilatories, such as a strong solution of barium sulphide made into a paste with powdered starch. We believe all depilatories likely to prove effectual are liable also to injure the skin. See also "Removal of Hair by Electricity," in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 176 and 353.

(15) L. W. Jr., desires receipt for making solder that will mend tinware without the use of acid or the soldering iron. A. This is probably what is called bismuth solder, and may be made by melting and mixing 40 parts tin, 20 parts lead, 40 parts bismuth by weight, and run into small bars by pouring from a perforated ladle while drawing the ladle across a flat piece of iron, stone, or board.

(16) H. J. W. asks: 1. Why does oil lubricate machinery? A. Because the oil keeps the surfaces from touching each other. 2. My showcase has become worn by contact with articles passing over it. Is there anything that will restore its brilliancy? A. You can partially repolish the glass by rubbing it with rouge on a piece of buckskin. Wet the rouge.

(17) L. B. H. asks: Will a pump lift as large a quantity of water from a well 20 feet deep as it will force 20 feet high? In the latter case the water is supposed to flow into the pump. A. Other things being equal, the difference will be in favor of forcing the water 20 feet with no suction. Water contains more or less air, which is liberated in the partial vacuum formed in the pump suction. This air enters the pump in a rarefied state and displaces some of the water; consequently, the pump is unable to deliver an amount of water equal to the actual displacement of the piston. If the suction pipe leaks even a small quantity, the difficulty will be increased. When the water is delivered to the pump and no vacuum is formed, the cylinder will be entirely filled with water, which must be displaced at each stroke of the piston. Consequently, the full capacity of the pump will be realized

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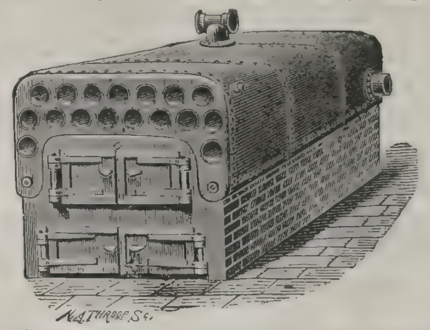

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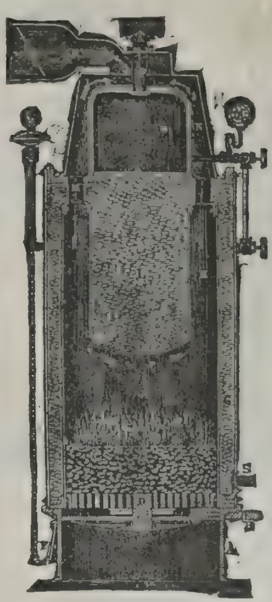

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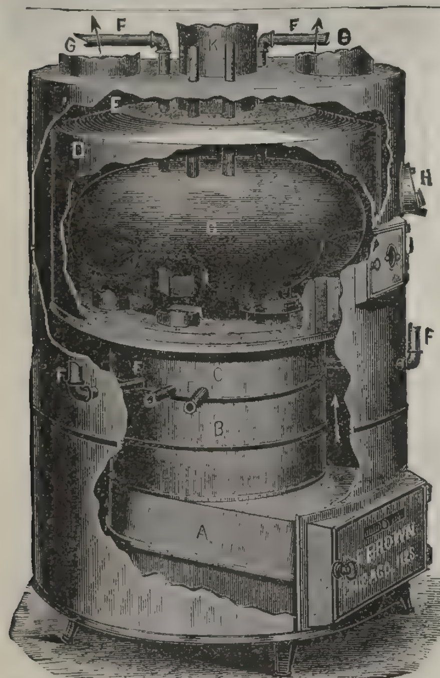

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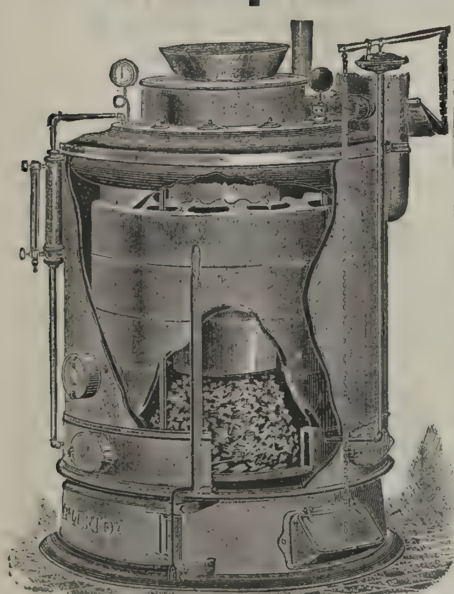

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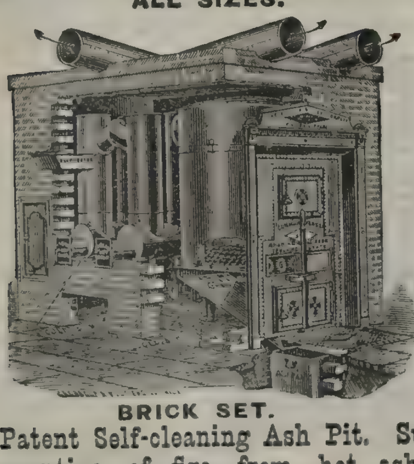

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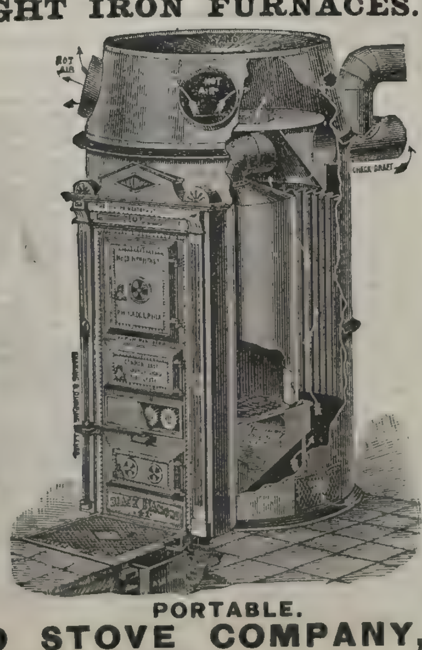

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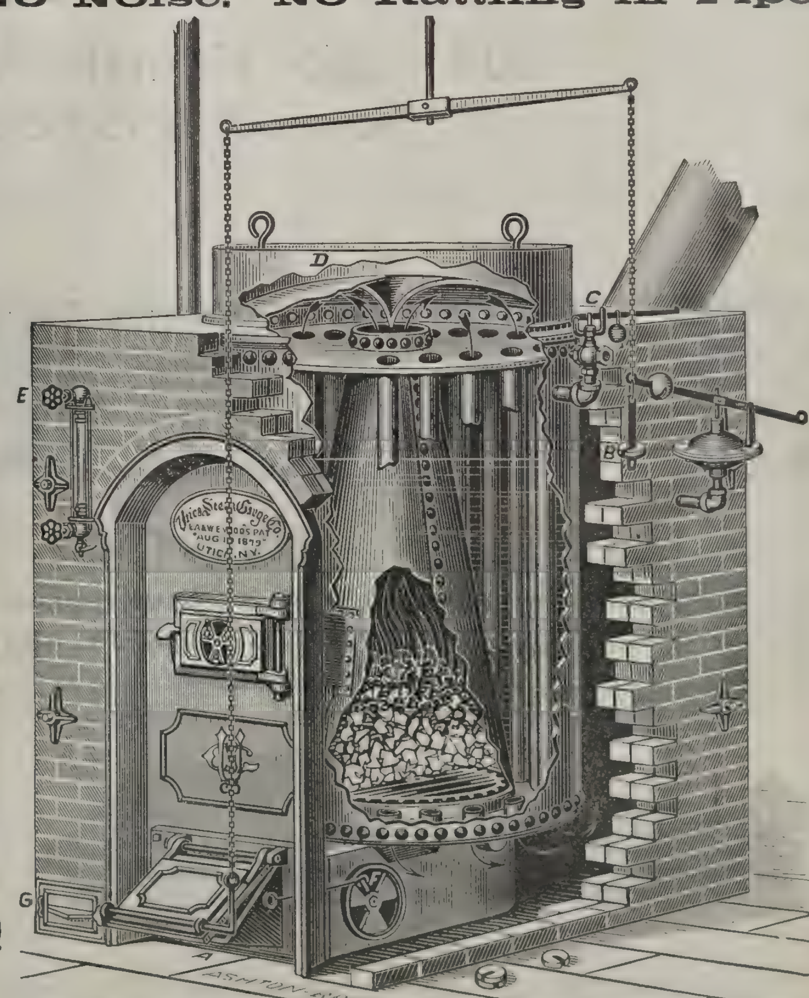

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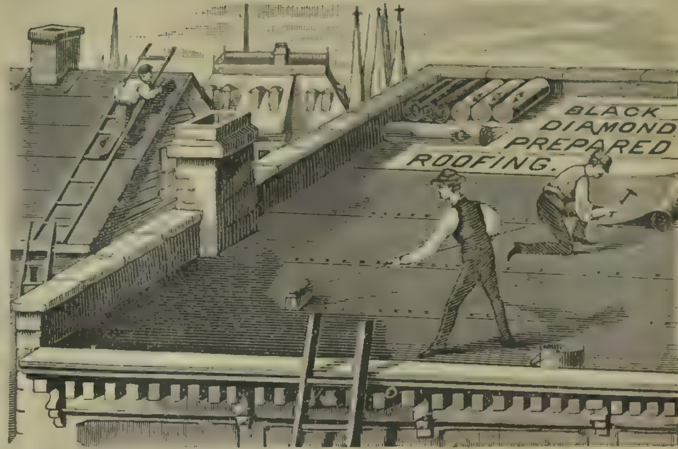

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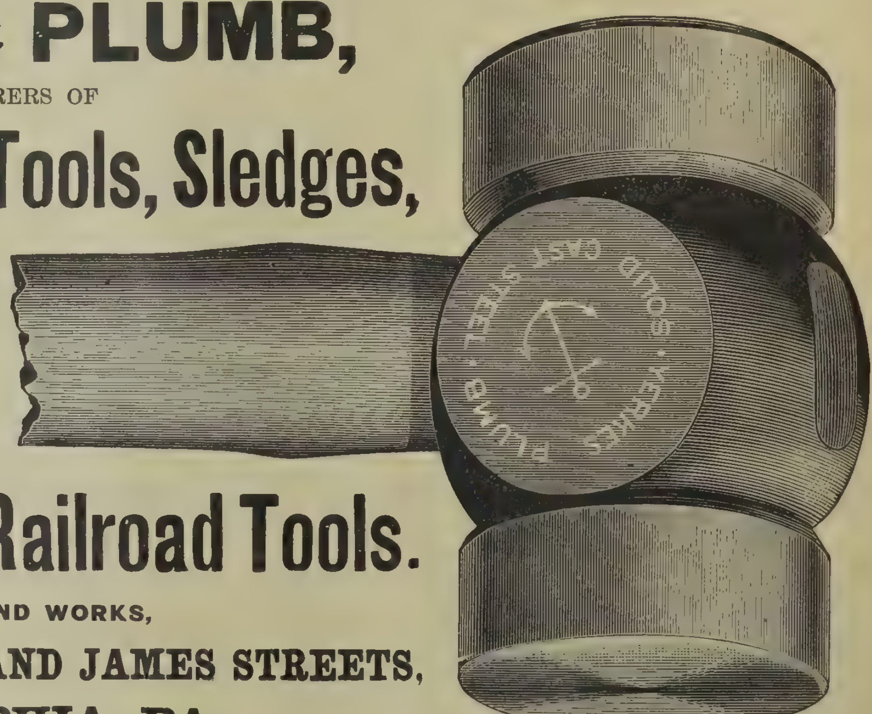

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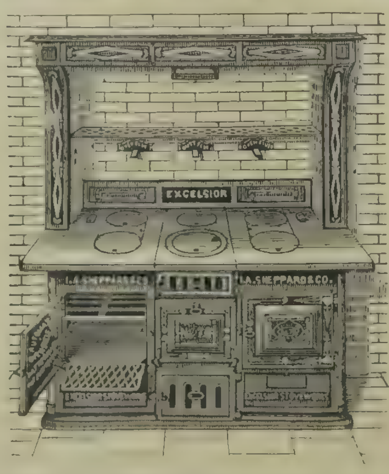

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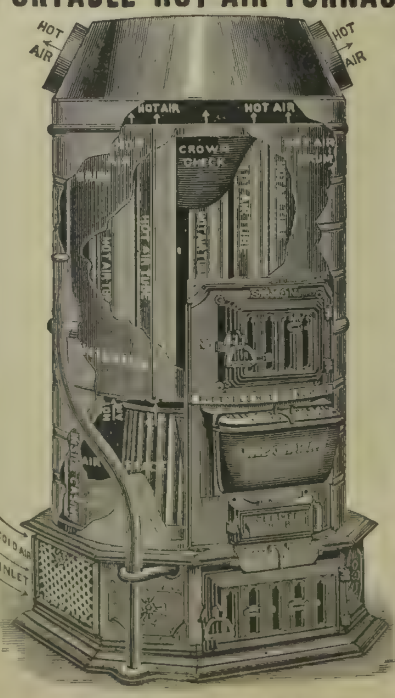

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A BRICK ROW OF MODERATE COST.

One of our colored plates for the present month illustrates a design for a row of brick and stone dwellings. We give a condensed specification of work and materials for the erection of the same, to be known as "Alhambra Terrace," according to the drawings and this specification, prepared by W. Claude Frederic, architect, No. 65 W. Fayette Street, Baltimore, Md.

General Conditions.—The contractor is to furnish all the materials of the best that can be procured, at the contract price for row. As the scheme for this row is an adaptation of the beautiful Moorish forms, the contractor must be careful to follow out, as far as possible, the idea intended, as in the selection of wall paper, gas fixtures, interior finish, etc. All workmanship must be thorough.

Do necessary excavating for cellars, areas, cesspools, etc., and grade off the yards. Go to sufficient depth for footings for foundation walls. Foundations are to be of 6 in. flag stones, not less than 24 in. wide; build up the walls on these, side, rear and division walls, 9 in. all the way up. Front walls, where stone, 18 in.; above, where brick, 14 in. Best quality Baltimore pressed brick laid in black mortar for fronts. Other walls to be run of kiln Peerless enameled bricks, blue and buff for panels where shown. Terra cotta pillars, panels, tiles, and ornaments from Boston Terra Cotta Company, all to be set in neat manner.

Stone for front coping and steps to be Hummelstown stone, rock faced. Carefully build all flues, fireplace arches, etc. Use Moorish terra cotta tiles for front of roofs, and line all the recessed work of balconies, etc., with them. Set coal chutes in pavements for each house.

Carpenter's Work.—Joists first floor, 3 in. × 10 in. or 12 in.; second, third and basement, 3 in. × 9 in. Floors to be well seasoned narrow tongued and grooved boards. Vestibules and the reception hall of house "B" to be tiled with mosaic work. Stair cases to be strongly framed, risers to steps not to be over 7½ in. All stair work to be quartered oak, balusters to be spindle work, as shown; newels 4 in. × 4 in. turned, hand rail. All to be smoothed, oiled, and wax finished. Build the ordinary steps to basements, areas, etc. Put shelves in all closets. Fit up pantries, dressers, etc. Build rough board fences, in usual manner, around yards, to be not less than 7 ft. high. Furnish gates to alleys, and build servants' outhouse in each yard over the cesspools. Wood cornice to front of houses where shown. Doors follow out the designs shown. All windows, except those in cellars, to be hung on pulleys and weights in usual manner. There are no inside shutters, but outside Venetian blinds to rear and sides. Good quality of hardware throughout must be used. Sheathe roofs for tinner. Where sliding doors are shown, hang them on Prescott hangers. All principal doors, casings and window-casings, mop-boards, etc., must be ash, as also all woodwork in bath rooms, including a 4 foot wainscoting. Frame up in ceilings where indicated for small segment dome. Build dome over bay of house C, where shown, and cover with tin. Set wood mantels as shown by detail in reception rooms, dining rooms, etc. Carefully frame all balcony and exposed wood work as shown.

Bell Hanger and Plumber.—Hang bells in kitchens to ring from front door, parlor, dining room, and second story front, and speaking tubes from butler's pantry to kitchen. Plumber is to furnish each house with a double extra zinc bath tub, 2 ft. by 4 ft. 6 in., ornamental china wash bowl, all with nickel plated spigots, etc., and a good quality sanitary w. c. Carry ventilation pipe from same up three feet above roof, to be of same size as soil pipe, which must connect with cesspool in yard. Test with hydraulic pressure to see if it is tight. Cast iron sinks for kitchen and pantry, 16 in. × 24 in. Thirty gallon boiler for range and soapstone stationary tubs for laundry.

Make necessary connection with city water supply. Lay all water and gas pipes through house where necessary, and test same to see if tight. Carry waste pipes from bath room, pantry, kitchen, and laundry to gutter. Furnish selected, designed gas fixtures, and hang same.

Tinner.—Cover all roofs with good roofing tin, in best manner. See that tin is painted on both sides. Floors of balconies to be covered with sheet copper, with two coats in usual manner, last to be skim finish, and arrange gutters in same with usual down pipes, and for roofs, also, all complete.

Plaster Work.—Plaster all interior walls, ceilings, etc., with two coats in usual manner, last to be skim finish, for papering, except in closets, basement stairways, kitchens, etc., which are to be white coated in best manner. Set plaster arches, panels, etc., in ceilings where indicated, and line the small domes with wire, lath, and plaster. All corners must be true and square. Lime-wash all cellars, fences, etc., and leave the row in a neat and clean condition. Good quality paving bricks for front pavement, cellars, and paths in yards.

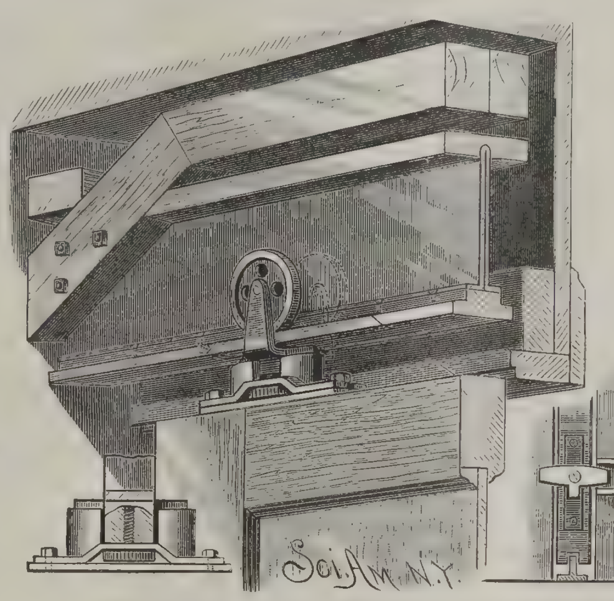
Sod yards and front grass plats with good grass.

Furnace, etc.—Set a No. 2 Tubular furnace in the cellar of each house, to heat front halls and rooms, and Baltimore Fireplace heater in dining rooms, to heat same and chambers over. Set a good single oven range in kitchen, with ventilator over.

Painting and Glazing.—Glaze all windows with good quality Baltimore glass. Bevel glass in panels of vestibule doors. Where colored glass is indicated, jewel glass in lead must be used. Firmly set all glass. Paint all exposed woodwork three good coats of colors indicated. All interior work to be painted two coats light tints, to correspond with wall paper. Smooth and varnish all hard wood, and finish up everything in first-class manner.

Paper Hanger.—Paper all rooms halls, ceilings, etc., in the best manner. Arabesque design wall papers. Decorate all ceiling panels in best manner. Friezes to principal rooms to be Lincrusta Walton. See that all decoration is carefully carried out

Finally, all the work hereinbefore specified or referred to is to be carried out to the true intent and meaning of this specification and the accompanying drawings. Such a row can be built in Baltimore for about ten thousand dollars, all complete.



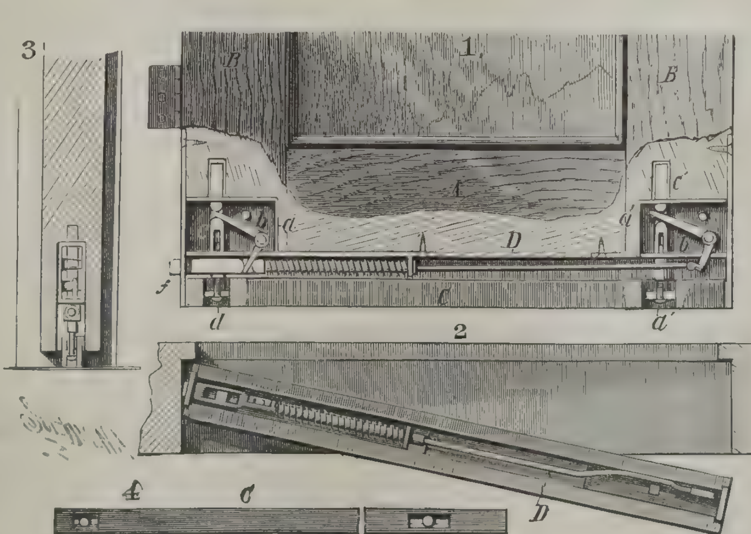
WAHL'S IMPROVED DOOR HANGER.

IMPROVED DOOR HANGER.

Although applicable to any other form of door, the hanger here illustrated is designed especially for use in the hanging of parlor doors. By its means the doors may be adjusted so as to hang in a perpendicular line should the building settle unevenly. The hangers proper consist of plates secured to the upper edge of the door, and each of which carries upwardly extending bolts provided with heads. Above these plates are others formed with standards, whose approaching faces are formed with V-shaped grooves, the bottom of the plate being formed to receive the milled head of an adjusting screw. In one end of each of the upper plates is a longitudinal slot, while in the other end is a transverse slot; through these slots the holding bolts pass. The wheel-carrying brackets are formed with arms, to which the wheels are studded, while the main body of the bracket is formed with sections that fit in the V-shaped grooves of the standards. The bracket also has a threaded socket to receive the adjusting screw. The wheels run upon a track or way, strengthened and stiffened by a truss, and the construction of which is clearly shown in the engraving. A gravity catch, of simple and novel construction, prevents the accidental withdrawing of the door.

It will be seen that the track and its supporting attachments must be secured in position prior to the finishing of the door frame or case; and in order that the wheels may be passed to a position above the track, pockets are formed in the track and in the horizontal jamb of the casing. The pockets consist of strips cut out from the jamb and from the track, the two cuts being made at an angle, in order that the strips may be held in place by screws. It is evident that these hangers can be easily and quickly put up, and that the doors can be readily brought to a perpendicular position through the medium of the adjusting screws.

This invention has been patented by Mr. William C. Wahl, of Buffalo, N. Y.



MACKIE'S IMPROVED DOOR ATTACHMENT.

IMPROVED DOOR ATTACHMENT.

The accompanying engraving represents a door attachment by means of which the space between the bottom of the door and the floor can be closed, thereby obviating the necessity of employing thresholds. The lower edges of the rail, A, and stiles, B, are grooved to receive the sliding stop, C, and rod, D. In casings, *a*, arranged on opposite sides of the door, are pivoted bell crank levers *b*, whose longer arms pass through bolts, *c*, which slide vertically through the casings. In the lower ends of the bolts are inserted adjusting screws, *d*, which pass through crossbars in mortises in the sliding stop, C. The rod, D, has an enlarged end, *f*, projecting through the flange of the casing, beyond the edge of the door, in position to engage with the door jamb as the door is closed. The shorter arm of one lever extends through a mortise in the rod, to the opposite end of which the short arm of the opposite lever is pivoted. The rod is made in two parts, one of which screws within the other, so that the length can be adjusted according to the width of the door to which the attachment is applied. A spiral spring is so arranged upon the rod as to press the end, *f*, outward, and thereby compel the levers to lift the bolts, *c*, and raise both ends of the sliding stop, C, simultaneously, when the rod is released by the opening of the door. This operation lifts the stops from the floor as the door begins to open, so that it may be swung freely in either direction. When the door is nearly closed, the contact of the enlarged end of the rod with the jamb pushes the rod in, turning the levers on their pivots, and allowing the stop to drop into contact with the floor.

This invention has been patented by Messrs. Mackie Bros., of 473 Warren Avenue, Brockton, Mass., who will furnish further particulars.

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CONTENTS

Of the December number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

Back Numbers.

At present we are able to supply to new subscribers the back numbers of this journal from its beginning in November last. Each number is accompanied by a sheet of colored plates and a sheet of details.

TO OUR READERS.

The present number completes the year, and brings around the time for renewal of subscriptions.

We shall be pleased if our friends will promptly send in the amount, $1.50, for their own subscriptions; and doubly pleased if they can add the money for an additional name from among their friends.

As a gift for Christmas or New Year's, what could be more appropriate or more highly appreciated as a present, to son, nephew, cousin, or worthy friend than the present of a year's numbers?

The beautiful style of the publication, its elegant illustrations, the varied, interesting, and useful nature of its contents, combine to make it desirable and welcome to every one.

During the forthcoming year we shall strive in every possible way to improve and extend the usefulness of our work. To this end we shall be glad to receive from our readers such hints and suggestions as may occur to them concerning subjects and features which they would like to have brought forward.

Those who are able to write upon practical matters relating to building, plumbing, masonry, plastering, the preservation and adornment of homes, dwellings, and their surroundings, are cordially invited to communicate with the editor. Architects and builders who possess new designs which they would like to see published, whether in colors or otherwise, are invite to submit the same.

The greater the variety of illustration and information thus presented, the better.

OUR FIRST TWO VOLUMES.

The present number ends our second volume, and completes the issues for the first year of the publication.

The first and second volumes of our ARCHITECTS AND BUILDERS EDITION are now ready for delivery, bound in handsome paper covers. Price, $2.00 each. To be had at this office and of book and newsdealers throughout the country. Those who have not seen a year's collection of our numbers put together will be surprised at the wealth and variety of contents which these volumes present, as well as at the cheapness of the price.

These two volumes contain all the numbers of the work from its commencement up to and including December, 1886. They embrace twenty-eight splendid plates in colors, representing the perspective elevations and plans of various dwellings, all having attractive features; fourteen large double sheets of details of construction of structures; nearly two hundred additional engravings of architectural subjects, public works, buildings, dwelling houses, cottages, etc., with plans; and upward of six hundred other engravings, mostly of superior character, illustrative of works and subjects interesting to architects and builders. Including all the separate diagrams and engravings of construction details, the two volumes present not far from two thousand illustrations. The reading matter covers a large variety of useful and excellent subjects, interesting to every one. No architect, builder, contractor, engineer, or householder can afford to be without this splendid work.

INDIAN ORNAMENT IN HOUSE DECORATION.

Persons seeking new ideas in the decoration of house interiors will be attracted by the extra colored plate showing a design for a "reception room," contained in this number of our journal. It illustrates the application to decorative purposes of specimens of East Indian ornament, as reproduced and adapted by the Messrs. M. H. Birge & Sons, of Buffalo, N. Y. In a special line of paper hangings of their manufacture, which they name the "Birge Velours," this firm last year introduced a number of Moorish patterns, taken from the sumptuous ornament of the Alhambra, and the success attending that venture has induced them to extend their search for novelties still farther east. The result would seem to show that the decorative art of India lends itself quite as readily and effectively to certain Occidental requirements as that of the Moors.

Most of our readers are probably aware that the art of India comprises two very distinct and dissimilar products. That which may be called "Hindoo" art had its origin in the country prior to the influx of Mohammedanism, and reflects the spirit of the older religions of the people. By Indian art proper, however, is usually meant that which has grown out of the Arab invasion and conquest. Possessing marked characteristics, which have always commanded the admiration of artists, it is nevertheless as essentially Arabesque as the Alhambra itself. While the Hindoo ornament abounds in grotesque and barbaric features, that of Mohammedan India discloses a delicacy and refinement not elsewhere surpassed, if, indeed, ever equaled. Monstrous human and other animal forms appear in the art of the Brahmins and Buddhists, while the creed of the Arabs, as strictly as the law of Moses, forbade the copying of the shapes of man or beast. It was through the London exhibitions of 1851 and 1862 that this later development of Indian art was first brought to popular attention in England. Competent critics at once pronounced it a happy blending of the severe forms of Arabian and Saracenic art with the graces of Persian refinement. Rather more flowing and less conventionalized than the pure Saracenic style, it is equally devoid of superfluous ornamentation, while it preserves the same division and subdivision of general lines which form the charm of Moresque decoration. "In equal distribution of the surface ornament over the ground," says the English critic whom we have already quoted, "the Indian artists exhibit a rare instinct and perfection of drawing, while the balance of color is so exact as to defy European imitation. The most brilliant colors are used, but always in perfect harmony."

It is from this pure fountain of Indian Arabesque that the Messrs. Birge have drawn a quantity of ideas for decoration, and, among others, the patterns illustrated in our plate. "The Taj, at Agra," they tell us, in a pamphlet from their house, "the most exquisite piece of architecture in the world, erected by Shah Jehan in memory of the beautiful Nour-Mahal, has furnished us with many suggestions for Indian ornament. These we have carefully adapted and arranged for both hangings and borders, preserving, as far as possible, the wonderful beauty of coloring of the originals." The window grilles, of carved wood, and the table, in the plate, are also from Indian patterns. There can be no doubt that here is a rich treasure house of ideas awaiting our artists and decorators, for the decaying mosques and palaces of Delhi and Agra abound in architectural ornament of the rarest and most exquisite description. The only wonder is that such a mine has been so little explored. Perhaps the patterns reproduced in the "Birge Velours" may create a demand for more from the same source.

ARCHITECTURAL OUTLINES.

Of the chief elements which go to make up an architectural design, there is one which, it seems to us, deserves special mention, because it is so frequently lost sight of, even by those in the profession. We refer to the question of sky lines. Its importance may be judged by making it the test of the effectiveness of any study under consideration.

Natural effects are due almost entirely to color, tone, and outline, and not to detail, for we are all more or less near-sighted, and incapable of appreciating the wonderful delicacy of Nature's handiwork, unless we take it by piecemeal. The spirit of true architecture aims to build so completely in harmony with its surroundings that the structure becomes an integral part of the landscape. We are indebted to nature for the materials with which we work and for the forms which we imitate. The debt is but ill repaid if, in our hands, what was originally admirable becomes distasteful.

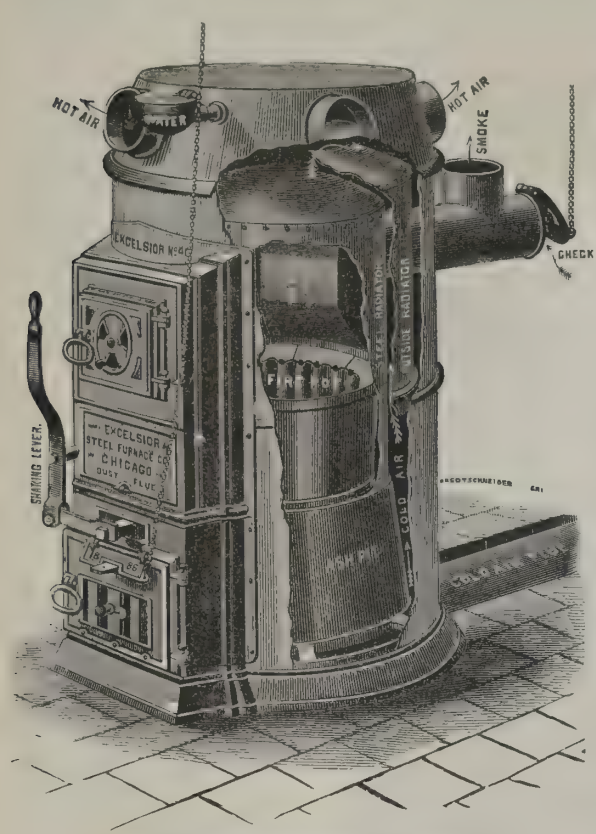
The introduction of the broad style in modern painting has shown our architects the possibilities open to them in coloring, and they have acted on the suggestion with an enthusiasm which makes it not improbable that we shall shortly need to advocate a little chromatic self-restraint. But they have been less assiduous in their attention to the second tenet in the creed of the impressionist—the demands of form. Particularly is this the case in the usual management of the roof. In spite of the gratifying advance made by architecture during the past decade, it is rare, even at the present day, to find a building which is perfectly satisfactory in its sky lines. Everything else may be pleasing, but if the design fails in this respect, the main effect is lost. The difficulty seems to be in a failure to appreciate the significance of architectural unity. Some predominant feature in the roof is needed to give the building an expression of dignity and repose. It is a point quite worth the attention of architects, for the effectiveness of a design is largely dependent upon its sky lines.

Sleep as a Mechanical Operation.

A writer on the philosophy of sleep declares that sleep is prevented by an excess of blood in the brain, and proposes, as a remedy, to pump the blood back from the brain by a peculiar method of breathing, for which directions are given as follows: Having assumed the usual posture for repose, the person is to inhale and exhale slowly and steadily long breaths, devoting the whole attention to making the inhalations and exhalations exactly the same length, the length to be much greater than that of ordinary breathing, although not sufficient to disturb the circulation by working the lungs to their utmost capacity. In support of this theory, reference is made to the feeling of faintness produced by filling the lungs with all the air they will hold and then expelling it, repeating the operation rapidly three or four times; the resulting faintness is attributed to the withdrawal of blood from the brain, and the same effect, substantially, follows any sudden and extreme emotion. So violent a disturbance of the system, however, is not advised for the purpose here sought, but a steady and gradual diversion of the blood from the brain to the lungs and body.

THE EXCELSIOR STEEL FURNACE.

The principal considerations which determine the choice of a furnace for domestic heating are the amount of heat furnished from a given quantity of fuel, the first cost of the complete apparatus, and the expense of subsequent repairs. The Excelsior Steel Furnace Co., of 18 to 22 North Clinton Street, Chicago,



THE EXCELSIOR STEEL FURNACE.

Ill., manufacture a heater of considerable merit, being designed with special regard to these principles.

The accompanying perspective, having portion of the exterior broken away to disclose the interior construction, clearly indicates the general arrangement of the parts of the furnace. The ash pit and fire pot are of heavy metal, suitable for sustaining the superincumbent weight, and are made of fine quality iron, to bear the great wear put upon them. The fire box is made in sections, to lessen the expense of restoration in the event of accidental breakage, and is provided with upright corrugations to facilitate combustion, and with air holes at the upper edge to insure a rapid combustion of the gases.

Two grates are provided, of a very convenient and carefully considered design. The bars of the upper or shaking grate are inclined toward the center, and the lower or dumping grate is supported by arms which rest on a grooved bar, and is provided with a handle, so that it may be moved backward, and permit raking off the clinkers without disturbing the fire above, which rests upon the shaking grate. The advantages of this arrangement in preventing clogging and the escape of gas, which always takes place, more or less, where there is a break in the fire pot and radiator, is an important and valuable feature of the heater.

The radiators in every heater are obviously of great importance, and to a great extent determine the efficiency of the apparatus as a fuel economizer. Here we have two, made of the finest quality of steel plate, with riveted joints, to prevent the escape of gas. The radiating surface is large, and its arrangement with accompanying checks is well adapted to prevent any considerable amount of heat escaping up the chimney, and in checking its velocity when necessary.

For the purpose of providing moist air, a specially formed vapor pan or evaporator is employed. On the top of the deflecting plate is placed a coil of four inch wrought iron pipe, provided with a half round basin or cup, into which the water is poured, and also with perforations through which the evaporation takes place in a natural manner, free from steam or the objectionable smell attending the use of an apparatus in which the water pan is immediately over the fire pot. A dust flue extends from the ash pan to the feed door, to draw off all dust that may arise when the fire is disturbed by shaking, and a return flue is provided at the bottom with an opening, so that all dust that is produced by the furnace may fall immediately into the ash pot.

The chains connected to the dampers may be regulated, if desired, from an upper floor. One damper is always closed while the other is open, and a slow or rapid combustion may be obtained by a simple movement of the chain.

The completeness and economical arrangement of the parts, and the common sense manner in which the whole furnace is designed, make it one of the best heaters now in the market. The price is not high, and, considering the quality and durability of the materials used in its construction, and the ease with which portions may be replaced as required, there is little doubt but that it is, at the same time, the cheapest.

To Protect Iron from Rust.

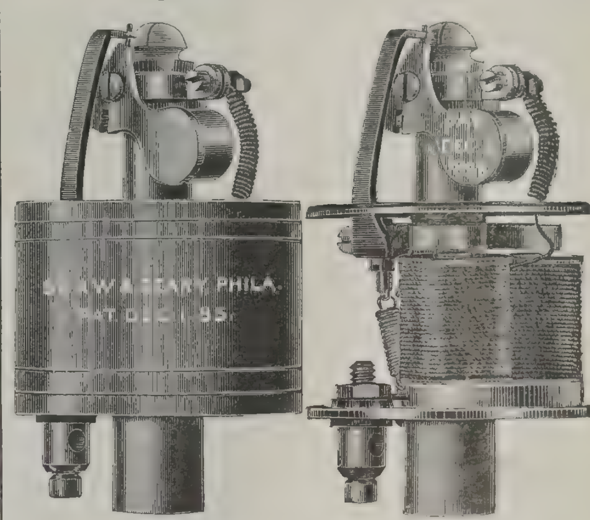
Prof. Calvert has recently made the interesting discovery, by practical tests, that the carbonate of potash and of soda possess the same property of protecting iron and steel from rust as do those alkalies in a caustic state. Thus it is found that if an iron blade be immersed in a solution of either of the above carbonates, it exercises so protective an action that, if it is exposed to a damp atmosphere, it will not oxidize, even after so extended a period as two years. Similar results, it appears, have also been obtained with sea water, on adding to the same the carbonates of potash or soda in suitable proportions.

NEW ELECTRIC GAS LIGHTER.

This is a simple, effective, and economical little device for lighting gas by electricity, especially applicable for use in churches, theaters, halls, public buildings, stores, and show windows, where the chandeliers and gas lights are apt to be inaccessible, and the lighting by torches is dangerous or difficult. By means of this little device, it is only necessary to turn on the gas and touch a button or buttons, when the gas is instantly lighted by an electric spark.

Our engravings illustrate in full size the new style of electric lighter as now made and supplied by Messrs. Shaw & Geary, of 53 North Seventh Street, Philadelphia, Pa. The figure at the left shows the exterior of the burner; the right shows the burner with its case removed.

In ordinary electric lighting apparatus, the guides for the electrodes invariably corrode and prevent the burner from operating.



NEW ELECTRIC GAS LIGHTER.

In this improvement the burner is readily adjusted to any desired quantity of battery, and will give the most reliable and satisfactory results, whether used daily or left idle for months.

It is so constructed that its electrodes make a rubbing contact when in operation, tending to keep them clean and bright, thus avoiding corrosion and the accumulation of dust at their contact points. These important features render it reliable and at all times certain in its practical operation.

MODERN ATHENS

Is a city of curious contrasts. The old and the new strive for prominence. The city now has about 70,000 inhabitants, as against 180,000 in the classical age. New Athens, extending toward the slopes of Mount Lycabettus, is built chiefly of marble, with well planned streets, squares, and gardens. On the ex-

THE TEMPLE OF JUPITER OLYMPIUS AT ATHENS.

treme east is the Royal Palace, on a commanding site fronted by a large square. From it Hermes Street, a broad avenue, runs due west, as far as the railway station and the ancient cemetery, whence another road continues to the Piraeus Hermes Street is intersected almost in the center of the city by Æolus Street, or the Rue d'Eole (the "Street of the Winds," illustrated in the *Graphic* recently), which runs almost due north and south from the Polytechnic School to the Acropolis. Stretching right and left from the Palace are two fine boulevards—the Boulevard de l'Universite and the Boulevard des Philhellenes. The latter follows the course of the city walls, passing the Arch of Hadrian and the Military Hospital, and running south of the Acropolis past the Odeum and Areopagus, coming up again to the railway station. The Rue de Patissia, which is the northern prolongation of the Rue d'Eole, is the fashionable promenade of Athens. The houses in the principal streets are generally built in the common German style, though generally with a few additions from Greek architecture, which produce a highly incongruous effect. The footpaths are in some streets of white marble, so dirty, however, as to be unrecognizable. All the smaller streets of Athens are mere lanes. Most of the best houses are in the Boulevard de la Reine Amelie, the Palace Square, and the streets which connect it with the Place de la Concorde.

The Athenians are fond of pleasure, and life in modern Athens, if busy, is also gay. The streets are always brilliant, and to an observer fresh from the West they offer a changeful scene of infinite variety. The crowded *cafes*, with their cheap sun blinds, frequented by young Athenians aping the dress and manners of the Parisian *gommeux;* the busy men of business in the commercial part of the city, hurrying along to the bourse or to their offices; the crowds of carriages and well-dressed loungers in the fashionable quarter of the Rue de Patissia, contrast curiously with the Acropolis and its ruined temples which looks down on it all, as it looked down many centuries ago on the Athens of Pericles, with a life as brilliant and as restless. Grave Turks with fezes and swaggering Albanians with their curious petticoats add an interest to the scene.

THE TEMPLE OF JUPITER OLYMPIUS

Is one of the most magnificent ruins in or near Athens. It stands just outside the southeast corner of the city, on the banks of the River Ilyssus. The temple took 700 years in building, having been commenced by Pisistratus and completed by Hadrian. The work was continued by the sons of Pisistratus, but after their expulsion it remained untouched for nearly 400 years. So solid and immense was the structure, even in its incomplete condition, that one writer compares it to the Pyramids of Ghizeh. About B. C. 174, Antiochus Epiphanes commenced the completion of the temple, but some of its columns were afterward carried to Rome by Sylla for the use of the Capitoline temple. Of the 124 columns which originally formed the peristyle, only fifteen are now standing. To-day there is a *cafe* among the columns, as shown in our illustration on the preceding page. The first day of Lent, which is a festival in the Greek Church, is celebrated around these stately columns. Peasants from all the country round come in in their best dresses, and dance among the columns. The scene is one no traveler should miss. This festival seems to be a revival of some older celebration, with which, however, it has not been satisfactorily identified.

THE THEATER OF BACCHUS

is one of the best preserved monuments of ancient Athens. It was unearthed mainly by the exertions of the Prussian Archæological Institute, in 1862, and is now, as our illustration shows, in a very perfect state of preservation It was the model of all other theaters erected by the Greeks. The orchestra (where the chorus went through its "business") is in the form of a semicircle, the central part being paved in the form of a lozenge, while the seats for the spectators rise tier above tier.

THE THEATER OF BACCHUS AT ATHENS.

THE ACADEMY OF SCIENCE AND ART, ATHENS.

THE ACADEMY OF SCIENCE AND ART

is a modern building, which was commenced at the close of King Otho's reign, and completed in 1882. It stands in the Boulevard de l'Universite, not far from the Royal Palace. Its architect was Hansen, a Dane, and it is one of the most successful attempts to reproduce classical architecture. Colossal figures of Athene and Apollo occupy lofty columns in front of the building. They were the work of the Greek sculptor Drossi.—*London Graphic.*

A BLACK WALNUT butt log, recently cut in Charlton County, Mo., is 18 ft. long, 63 in. in diameter at the large end, and scales about 3,500 ft. It took four yokes of oxen to draw it from the woods to the railroad, and it makes a full car load of itself, weighing 26,000 lb. The second log of the tree, which is 12 ft. long, measures 43 in. at the larger end.

AN $1,800 COTTAGE.

Specification of work to be done and materials required in the erection of a cottage house according to plans and specifications prepared by Frank D Nichols, architect, Burroughs Building, Bridgeport, Conn.

A colored plate showing this house in perspective was published in the October, 1886, number of this journal; also plans of the first and second floors. We now give additional elevations, with specifications.

MASON'S SPECIFICATION.

Generally.—All the work to be done in a good, workmanlike manner. Materials to be of good quality of their respective kinds. All finished throughout in every respect as shown by and intended by the plans and this specification, even though not herein specially described or mentioned, and as directed by and to the satisfaction of the proprietor or his agent, employed by him to superintend the works.

Dimensions.—To be obtained from the plans. Figures, where shown, used in preference to measurement by scale.

Digging.—Excavate to the necessary depths for cellar bottom, trenches for walks, area piers, and drains. The surface earth is to be put aside by itself for subsequent grading. All superfluous earth or rubbish to be removed from the premises, or deposited upon or around site, as may be directed.

Drains.—The drains to be laid, as shown, to proper falls, and closely connected with conductors, water closet soil pipe, and sink and bath room wastes. Pipes to be 3 in., 4 in., and 6 in. vitrified drain pipes, jointed in cement, and left perfectly tight, and carried to the point shown in cellar, which is 8 ft. from front line of house. All pipe beyond this point necessary for the connection to sewer will be allowed for and paid for by the proprietor at the contractor's schedule price.

Foundation.—The foundation walls to be built of good quality building stone laid in mortar composed of two parts lime to one of cement, mixed with the proper quantity of good sharp bank sand. The wall to be 16 in. thick, well bedded and bonded, laid to a line on the inside, and neatly pointed as the work proceeds. Leave all openings necessary for drains and water pipes.

Underpinning.—To be of good, hard burned red brick, laid in lime and sand mortar, to be well bonded and leveled off for sill of frame. This work to be neatly pointed on the outside as the work proceeds.

Chimney—Build the chimney of good, hard, well burned red bricks; size of flue, 8 in. by 8 in. Leave all openings for stove and heater pipes. Line the open fireplace in parlor of selected bricks of even color in red mortar, showing 4 in. on face of jambs and a neat segmental arch over. Turn trimmer arch at level of first floor to take tile hearth. Top out the chimney under roof boards to a thickness of 8 in. around flue, and then carry above roof with projecting courses, as shown. All neatly pointed in red mortar above roof boards. Put in all necessary stove pipe rings and thimbles, and protect same with plaster of Paris around all woodwork.

Tile Hearth.—The tile hearth is to be laid in cement. Tiles to cost thirty cents per superficial foot. Inner hearth, slate, of 1¼ in.

Piers.—Build piers under piazza posts and posts in cellar 8 in. by 8 in. square.

Steps.—The area steps to be 4 in. by 12 in. bluestone, on brick risers and edge in cement.

Bluestone.—Window sills to cellar to be 4 in. by 8 in.

bluestone. Coping to area way to be 4 in. by 8 in. bluestone. Flats under rear porch, 4 in. by 12 in. by 12 in. bluestone.

Cellar Bottom.—To be well tamped, leveled off, and to have 1½ in. of good cement concrete on same, laid to a screed, and floated off to a smooth surface.

Plaster.—The ceilings, furrings, and partitions throughout to be lathed with sound spruce lath, laid full ¼ in. apart, and joints broken every twelfth lath, and over all door and window openings.

Brown Coat.—This lathing to be plastered one good coat of brown mortar, composed of fresh burned lime, sharp sand, and a sufficient quantity of strong cattle hair. This plaster to be mixed and banked at least four days before using, to be troweled on with sufficient force to get a good key, and to be smoothly floated. Plaster to run full height of closets and down to floors.

Finish Coat.—This brown coat to have finish coat composed of first quality finish lime and clean white sand troweled down hard and smooth, and mixed at least seven days before using.

Centers.—The parlor to have plaster center, to cost $2. The hall to have plaster center, to cost $1. To be approved by proprietor before being set up. Plaster arches over stairs, bay window, and between parlor and dining room where shown.

Cornice.—Run plaster cornice 6 in. by 10 in. around ceilings of parlor and hall.

Patching.—Do all necessary patching and mending of walls after plumber or other workmen.

Clean Out.—Clean out all mason's waste materials from the premises, and leave all floors broom clean.

SLATER.

The main roof (not piazza or porch roof) and tower roof to be covered with No. 1 Bangor slates, size 8 in. by 14 in., to be well nailed to roof boarding with galvanized iron nails. All slates to be cut octagonal. Do all necessary cutting for valleys and ridges, and leave roof clean and perfect at completion.

CARPENTER'S SPECIFICATION.

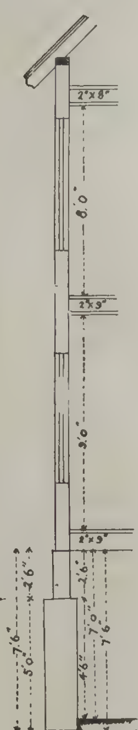
Generally.—All carpenter's work to be done in a good, workmanlike manner. Timber to be of good quality of its various kinds, free from sap, loose knots, or shakes. The joiner's work to be smooth and true. All finished throughout in every respect as shown by and intended by the plans and this specification, even though not specially described or mentioned, and as directed by and to the satisfaction of the proprietor or his agent employed by him to superintend the work.

Dimensions.—To be obtained from the plans, and figures where shown to be used in preference to measurement by scale.

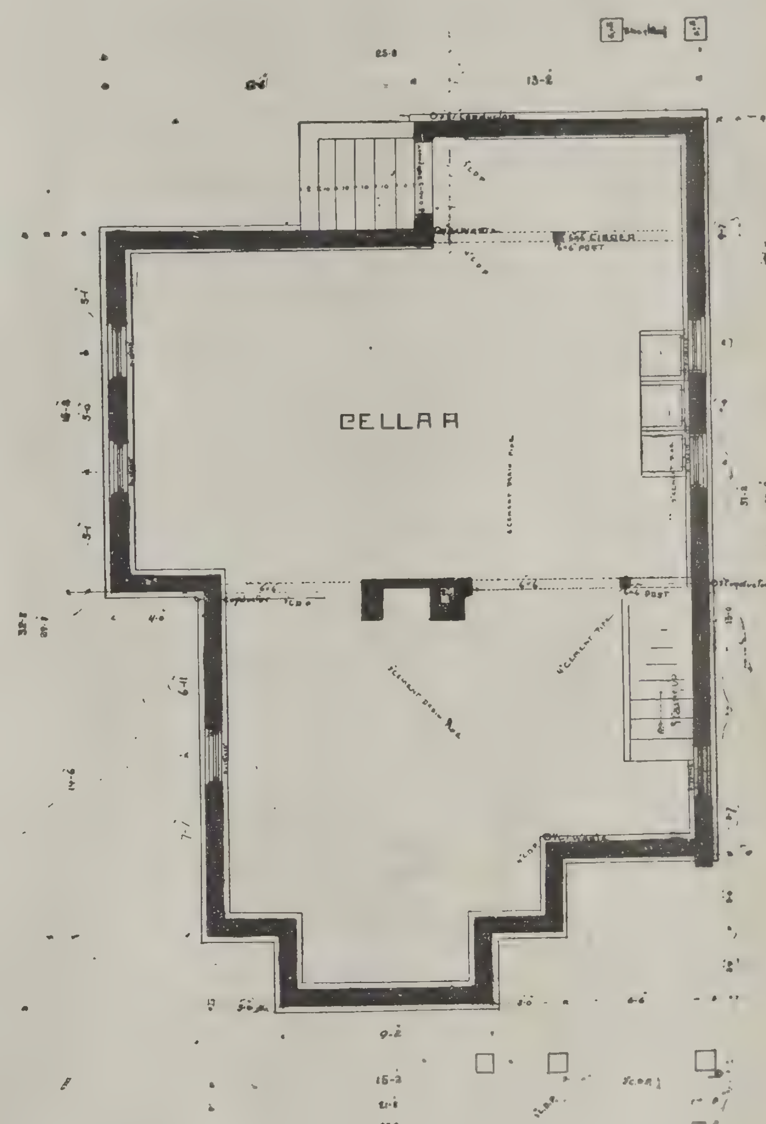
Timber.—Timber not exposed when finished to be sound seasoned spruce; timber on exterior that is exposed when finished to be of good quality white pine, clear on faces that show.

Posts and Girders.—The posts and girders in cellar to be 6 in. by 6 in. spruce.

Frame.—To be of spruce, of the following sizes:

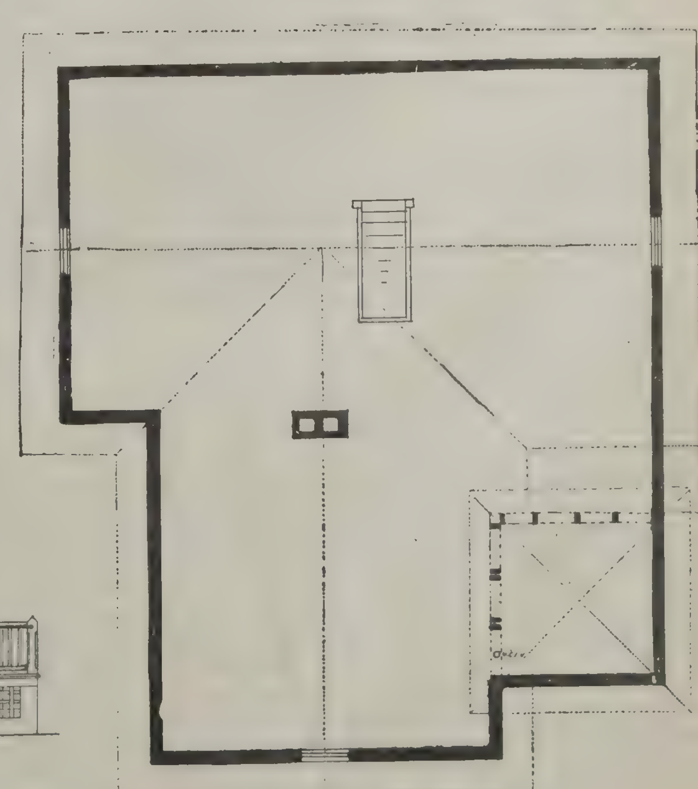


FRONT ELEVATION



CELLAR PLAN.

SIDE ELEVATION



ATTIC FLOOR PLAN.

AN $1,800 COTTAGE.

Sills to be 4 in. by 6 in., laid flat, halved together at angles, and mortised to receive tenon of angle posts; angle posts, 4 in. by 6 in., tenoned into sills; studs, 2 in. by 4 in., nailed to sills; door and window studs, 3 in. by 4 in.; girts, 1¼ in. by 5 in.; top plate, 4 in. by 4 in., in two thicknesses.

Roofs.—The roofs throughout to have rafters of spruce, 2 in. by 6 in.; ridge, 1½ in. by 6 in., spruce; valleys, 2 in. by 8 in., spruce; rafters, 16 in. on centers.

Joists.—Floor joists to be 2 in. by 9 in.; headers and trimmers to be 3 in. by 9 in.; attic joists to be 2 in. by 8 in.; trimmers to be 3 in. by 8 in.; piazza joists to be 2 in. by 6 in, spruce, framed in to 2 in. by 8 in. dressed white pine outer sill. All joists 16 in. on centers, and all joists having a bearing of 10 ft. or more to have a row of 1½ in. by 3 in. spruce bridging.

Partitions.—Studding to partitions that carry weight are to be 2 in. by 4 in., others 2 in. by 3 in., 16 in. on centers; heads, 4 in. by 4 in. and 2 in. by 3 in. Furnish all other timber required by the design of the necessary sizes and quality.

Sheathing.—Sheathe the framing with ⅞ in. spruce boarding, well nailed to studs.

Felt Paper.—Cover this sheathing with felt paper of good quality, well lapped and tacked. This felt paper to run also behind all door and window casings.

Siding.—The above specified felt paper to be covered with best dry beveled white pine clapboarding 6 in. wide, put on tightly with 1 in. lap, and set in nails for painting.

Corner Boards, Casings.—Corner boards, casings, and bands to be 1⅛ in. by 5 in. white pine.

Outside Finish.—The feet of rafters to be cut and dressed, and the eaves finished with 1¼ in. by 2½ in. moulding. The gables to have verge boards 2 in. by 8 in., collar-beam, king posts, and struts, all 2 in. by 6 in., chamfered and cut as shown. The gables to be filled in with best white pine cut shingles, as shown. Panels over windows to be filled in with narrow beaded white pine, as shown. The moulding to eaves to be carried around verge boards.

Bay Window.—Frame out for bay window and piazza as shown.

Piazza.—Posts to piazza to be turned out of 5 in. by 5 in. whitewood; brackets to plate to be 3 in. by 12 in. by 12 in.; plate to be of 4 in. by 6 in. spruce, cased with 1 in. clear white pine; feet of rafters to be cut and dressed; the spandrel to front piazza to be filled in with chamfered framing, as shown, of 1¼ in. by 6 in. white pine; hand rail of 2½ in. by 4 in. white pine, filled in with 1½ in. square white pine eccentric work; the rear porch to have 6 in. by 6 in. square chamfered posts; hand rail, 4 in. by 2½ in.; balusters, 2 in. square. The ceilings of piazza to have narrow white pine ceiling and neat moulding inside, same as cornice.

Tower.—Frame out for tower roof as shown; to have cornice formed of 1 in. by 4 in. ogee crown mould, 1 in. by 4 in. fascia, and 1 in. by 10 in. planseer, all of clear white pine; small brackets under each angle and elsewhere, where shown, 3 in. by 6 in. by 8 in.; provide and fix light iron finial, 3 in. by 6 in. in height from apex of tower to point, to cost $5.50 in New York; fill in with cut shingles where shown; eye windows to have 1½ in. fixed sash and 1¼ ogee moulding around outside, as shown.

Roof Board.—To be ⅞ in. spruce or hemlock, well nailed to rafters, prepared for gutters, cornice, etc. This boarding to be prepared to receive slate on main roof. The small flat back of tower and piazza and rear roof over pantry will be tinned.

Gutters.— To be formed of 1¼ in. white pine boards prepared to receive tin with cut stops.

Ridge Cresting.—To be of white pine, with cut finials as shown.

Frame Out.—Frame out for chimneys, stairs and scuttle in roof. Scuttle to be placed where directed, and to have curb and batten door hung to same.

Floors.—Lay the first and second floors with ⅞ in. second clear white pine floor boarding, in widths not exceeding 5½ in. Attic floor to be ⅞ in. spruce floor boarding. Piazza and porch floors to be 1¼ in. white pine, with paint joints.

Stairs.—From first floor to second floor to be of clear white pine. Strings 1¼ in. by 11 in., with 1 in. riser and 1¼ in. nosed treads, with ⅝ moulding under same continued around string. To have 1½ in. turned yellow pine balusters and 2½ in. by 3½ in. yellow pine hand rail where shown. The newel to turnout of stairs on first floor to be 8 in. by 8 in. by 4 ft. turned yellow pine. The newel at head of stairs to be 6 in. by 6 in. turned yellow pine. These stairs are not cylinder stairs. Stairs up to attic to have second clear white pine risers and 1¼ in. nosed treads, and ½ in. cove moulding under same, strings 1 in. by 10 in. The well hole of attic stairs to have hand rail, and posts of white pine around same. Cellar stairs to have 1½ in. by 10 in. string of spruce open riser and 1 in. by 8 in. nosed tread housed in. Build piazza and porch steps with 1¼ in. white pine risers, and nosed treads on proper carriages. The riser to piazza and porch to have 1¼ in. framing filled in with latticework as shown.

Inside Frame.—All door and window openings to have grounds to finish plaster against, and then to be cased with ⅞ in. by 4 in. beaded casings with turned sunk angle blocks and base blocks at door openings to stop base board, to be of North Carolina pine.

Sash Frames.—Sash frames to be made in ordinary manner with sash in same 1⅜ in. thick, double hung with cords, weights, and pulleys, screw pockets, etc. All windows to be glazed with double thick sheet of second quality. The sash in cellar to have 2 in. by 6 in. rabbeted plank frames, and 1¼ in. sash hung to same, with 2 in. butts and turnbuckle fastening, and hook and staple in joist to keep same open.

Blinds.—Windows, except to cellar and bay window, also gable, to have outside blinds of white pine hung with buffer hinges (best quality double spring) in two folds. The two blank windows in tower to have similar blinds, but to be closed and fixed. The bay window to have inside blinds of white pine ⅞ in. thick, prepared for filler.

Doors.—The sliding doors to be hung from top with Davis' door hanger, to have flush sunk latch pulls. The front door to be glazed as shown, to be 3 ft. by 7 ft. by 1¾ in., of whitewood, prepared for stain.

Hardware.—The rear door to be glazed as shown, to be 3 ft. by 7 ft by 1¾ in. The internal doors to be good ogee solid moulded six panel doors, hung with loose joint butts, locked with 4 in. brass mortise locks of good quality and white mineral knobs, and furniture of Berlin bronze on second floor. Hemacite knobs and furniture of Berlin bronze on first floor. The front door to have lock of the first cost of $2 50, with bronze furniture, and to have night latch in connection with lock. The front door to have 4 in. gong bell, with lever pull and bronze furniture to match door knob. All sashes throughout to have burglar proof sash lock. The cellar flaps at rear to have strong curb and batten doors hung thereto, with wrought iron hinges, and to have 8 in. wrought iron bolt on the inside, with hook and eye to keep door open against building.

Wainscoting.—The kitchen and lobby to be wainscoted to a height of 3 ft. with narrow beaded North Carolina pine, with neat moulding as cap. The bath to have similar wainscot, only 18 in. higher.

Mantels.—Provide and set in parlor a wood mantel to cost $15. Provide and set in dining room a wood mantel to cost $12. Provide and set in front bedroom a wood mantel to cost $8. Provide and set in kitchen a North Carolina pine shelf, 1¼ in. by 4 ft., carried on two strong and ornamental iron brackets. The wainscot to run 18 in. higher under shelf, so as to take brackets.

Base Board.—To be moulded, ⅞ in. by 8 in., except to pantries and closets, where it is to be ⅞ in. by 6 in. square.

Closets.—All closets to be fitted up with wardrobe hooks on neat strips, and one shelf in each.

Pantry.—To be fitted up with three tiers of shelves 15 in., 12 in., 9 in. wide respectively, of white pine. To have inclosure for flour barrel under lower shelf, and top hung with 2 in. butts, inclosure to be same as wainscoting. Fix in pantry one dozen pot hooks.

Sink.—To be neatly cased up same as wainscot, with door in same, properly hung and secured and one shelf under same. Sink to have grooved drip board of 1¼ white pine inclosed same as sink. Splash back around sink and drip 18 in. high, same as wainscot.

Water Closet.—To have riser of narrow beaded North Carolina pine, built as shown, with 1¼ in. seat of yellow pine and ¾ in. beaded yellow pine frame, and flaps hung thereto with 2 in. brass butts. All work to be screwed together so as to be easily taken apart.

Bath Tub.—To have inclosure of narrow beaded North Carolina pine, with 1¼ in. yellow pine nosed and dished top.

Wash Bowl.—To be neatly cased up same as wainscot, with door in same properly hung and secured, and one shelf under same.

Pipe Casing.—Soil pipe to be neatly cased up with narrow beaded North Carolina pine, screwed together so as to be easily taken apart.

Wash Trays.—Wash trays to be of 1¾ in. white pine, joints to be in white lead with division as shown, and flush sunk lids hung with hinges.

Angle Beads.—All exterior plaster angle to have 1¼ in. turned angle bead.

Door Stop.—Hardwood door stops with rubber tips to all doors that open against plaster.

Saddles.—All doors to have ⅝ in. beveled saddles of yellow pine.

Cutting.—Do all necessary cutting for plumber and other workmen. All carpenter's waste materials and rubbish to be removed from premises at completion.

PAINTER.

Generally.—Cover all sap and knots, pitch and gum, with strong shellac before applying the priming coat. All nail heads will be set in with the joiner. Putty the work smoothly after priming.

Exterior.—Paint all outside work (except front door) with two coats of lead and oil, in any two colors as may be directed, and line out with a third tint all mouldings, cut work, and chamfers. Shingles in gables to have two coats of lead and oil, finishing in tile red. This front door (whitewood) to be stained cherry, and to have filler and a finish in hard oil. Tin roofs to have a coat of mineral paint of approved color.

Interior.—The interior woodwork throughout to have a coat of filler, to be rubbed down, and then have a coat of varnish. The above includes casings, doors, inside blinds, base, hand rail and newels, wainscoting, window frames, mantels, etc. All work to be left clean and perfect at completion.

PLUMBER'S SPECIFICATION.

Generally.—All work to be done in a good, workmanlike manner. Materials to be of good quality of their respective kinds. All joints of lead pipe to be wiped brass ferrules where necessary. Cast iron pipe to be jointed, well calked, and left perfectly tight. Galvanized pipe to have screw couplings in white lead, and left perfectly tight.

Furnace.—The furnace will be provided by the proprietor. Pipes running from same to be provided and placed in position by contractor, size 3 in. by 11 in. Pipes running through floors to have tin collars and to be well protected. To have tin register boxes, casings, and black japanned registers with frames set in wall where practicable. Registers on first floor, 10 in. by 12 in. Registers on second floor, 8 in. by 10 in.

Water Supply.—The house is to be supplied with water from main in street, with ¾ in. galvanized iron pipe and ½ in. galvanized iron branches. Place a stopcock inside of front wall. This cock to have waste, and pipes laid so as to drain off all water that may be in the house pipes at the time of cutting off supply.

Boiler.—Provide and fix on a single legged cast iron stand a 30 gallon galvanized iron cylinder boiler, with domed and riveted head, and the usual copper tube inside. Connect (or leave connections between) the boiler and water back with ¾ in. seamless brass pipe with draw-off cock, and leave sediment cock at bottom.

Bath Tub.—Provide and fit up complete an overflow bath tub, placed where indicated, lined with 14 oz. tinned and planished copper. Supply same with cold water through ½ in. galvanized iron pipe and hot water through ½ in. "A" lead pipe, and ½ in. bath nickel plated compression cocks, fitted with flange and thimbles; put in socket strainer and plug, attach the plug with chain, all nickel plated. Put in 1½ in. "C" lead waste, carefully trapped and connected with soil pipe below water closet trap. The overflow to be connected with waste above trap with 1½ in. "C" lead pipe.

Wash Bowl.—To be of good quality white marble, 14 in. diameter, to be supplied with cold water through ½ in. galvanized iron pipe, and with hot water through ½ in. "A" lead pipe. To have ½ in. nickel plated cocks; to have 1¼ in. "C" lead waste, with trap and brass trap screw, and connected with water closet soil pipe. Slabs to be countersunk, of white marble, with backs 8 in. high. Bowl to have 1 in. "C" lead overflow, connected with waste above trap. To have nickel plated chain, chain holder, and plug.

Water Closet.—To be Demarest's patent No. 4 in. valve. A1 quality, supplied with water through ½ in. galvanized iron pipe, with stopcock in same, to control supply. Soil pipe to be 4 in. cast iron, to be continued above roof as ventilator.

Wash Trays.—To be supplied with cold water through ½ in. galvanized iron pipe and hot water through ½ in. "A" lead pipe, and ½ in. flange and thimbles, brass cocks with lever handles. Waste of 1½ in. "C" lead pipe, well trapped, and closely connected with sewer.

Sink.—To be of cast iron, 30 in. by 20 in. by 6 in., supplied with cold water through ½ in. galvanized iron pipe and hot water through ½ in. "A" lead pipe, and ½ in. finished brass compression cocks, 1½ in. "C" lead waste, with "Bower's" patent trap, and connected with drain with 2 in. cast iron pipe.

Tinning.—The bay window and piazza roof at rear over pantry, also small flat at back of tower, to be covered with tin of good quality, soldered in resin (not acid). Gutters in roof to be tinned, and gutter back of moulding and tower also to be tinned. Flash around chimney and tower with similar tin.

Conductors.—The conductors to be of stout galvanized iron (spiral riveted), closely connected with drains. All work to be left perfect at completion.

A Tall Chimney.

A chimney was built in 1885 for a lead smelting works at Pueblo, Col., which is 319 feet in height, 10 feet in diameter in the clear from the foundation up. It rests on 16 feet of smelter slag, which was poured in a liquid state in the ground 16 feet deep, and allowed to cool and solidify. On top of this, and above ground, is a second foundation 16 feet high, made of brick. The stack proper, which is 287 feet high, is made of iron and lined with fire brick. It is the largest stack west of the Missouri River.

RUSSIAN papers report that, on the 5th of October, at Tagieff's Well, in Baku, a petroleum fountain commenced to flow at the rate of nearly 11,000 tons of oil a day. The height of the fountain is over 200 feet.

INDIAN ROOM.

DECORATED WITH THE BIRGE VELOURS.

BY M. H. BIRGE & SONS, BUFFALO.

PORTSMOUTH, ENGLAND, NEW TOWN HALL.

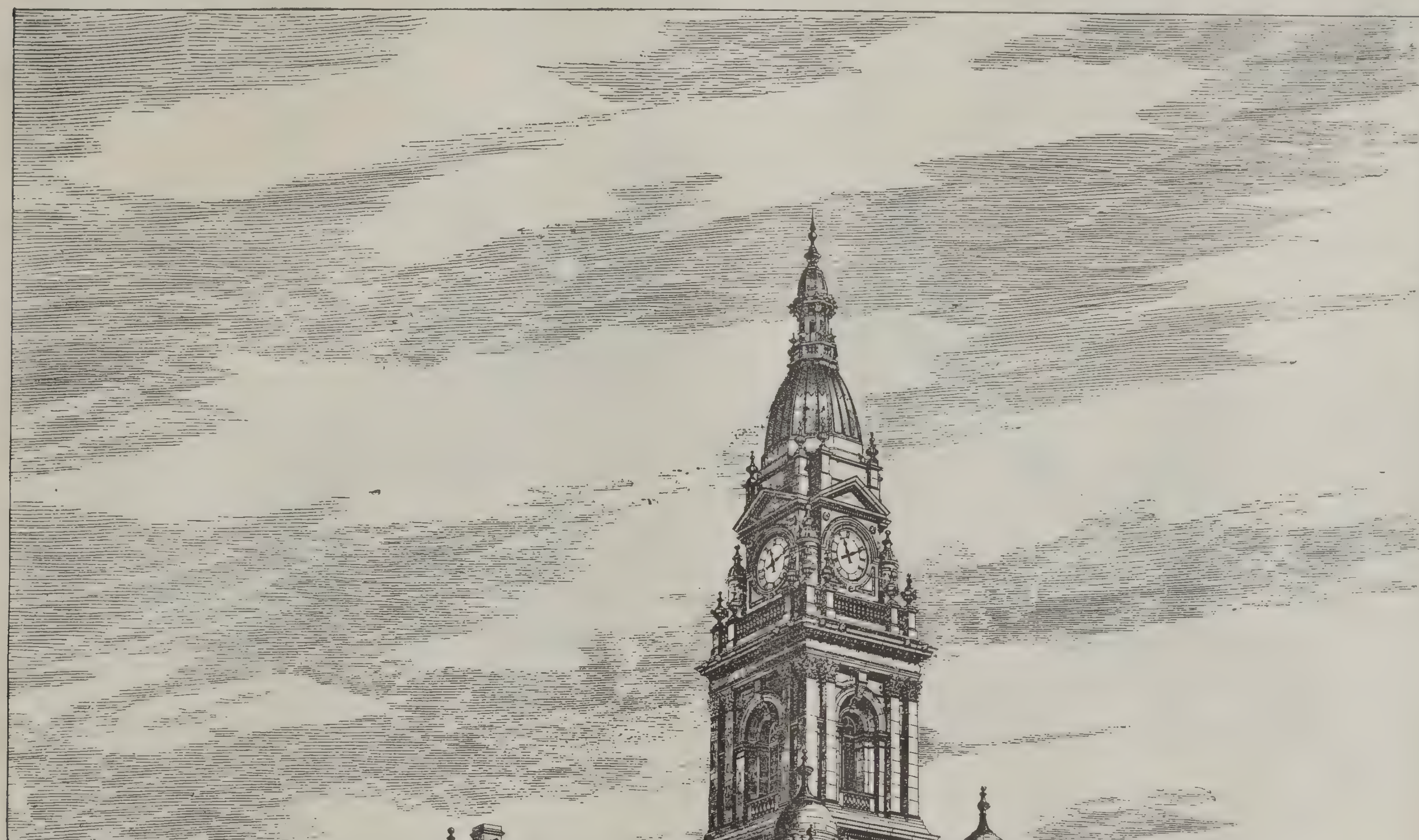
Mr. Wm. Hill, F.R.I.B.A., of Leeds, is the architect of the work. Portsmouth is to be congratulated on the choice of so suitable a design for its new Town Hall, and we trust that it will be furnished and finished in a complete and suitable manner at a not far distant date. —*Building News.*

A Model Cholera Hospital at Rome.

The London *Globe* gives an interesting account of a new cholera hospital at Rome, which the Pope has caused to be built. Contact with the outer world is carefully guarded against by grated windows, telephones, and by a revolving barrel, with half its circumference open, by which provisions are taken into the hospital. The water supply is drawn from a well, and is quite separate from the city supply. The drain is formed of an iron tube, sixteen inches in diameter, the joints being hermetically sealed with lead. There is a disinfecting boiler in which corrosive sublimate is placed. There is a room called the "chamber of observation," which has a staircase leading up to the first floor. In this room dead bodies are placed for a given time, as it is well known that cholera patients often show signs of being dead when really only apparently so. The room is, by means of an electric apparatus, in communication with the director's office. The body being laid on a bed, both hands are put into a sort of copper muff; between the hands is put an instrument so sensitive that, should there be the slightest movement of the hands or any other part of the body, this instrument would instantly close the electric circuit, and the bell in the director's office would be set ringing; at the same moment another instrument registers the number corresponding to the bed upon which the body is lying. The chamber is warmed by steam, so as to facilitate resuscitation. The laboratory is provided with a gasometer for the storage of oxygen, which is taken to the wards for administration in gas bags. On the ground floor are four wards for doubtful cases. Should they get worse, they are sent up in the lift to the cholera wards above, their clothes and bed linen being immediately burned. Another room is set apart for women in childbirth, and there are two more for undressing patients, so that the infected clothes may be destroyed, the Pope furnishing new clothing for all recovered cases. The cubic space allowed for each bed is thirty-six cubic meters. The ventilation is carried on by means of funnels with gas jets below. The chapel is in communication with the sacristy of St. Peter's, so as to form an easy access for the Pope, should he wish to visit the hospital; but before returning into the sacristy, his Holiness and suite would have to go into a room near it for disinfection.

Oil Tempering.

As to the value of tempering in oil, it is curious how doctors differ. Mr. Adamson, president elect of the Iron and Steel Institute, denounces the practice with characteristic warmth. He admits that a higher tensile strength is obtained, but says it is at the expense of ductility, and that a number of severe but unequal strains are probably set up by it, tending to facilitate or even commence rupture. On the other hand, Mr. Vickers, of Sheffield, who is certainly also a high authority, appears to hold a different opinion. He says that the important feature of oil tempering is not so much that it increases the ultimate tensile strength as that it raises the elastic limit, which is after all the great desideratum.



THE NEW TOWN HALL, PORTSMOUTH.
WILLIAM HILL F.R.I.B.A. ARCHITECT.

A STABLE AT BABYLON, L. I.

SPECIFICATION

of materials and labor required in the erection and completion of a stable to be built on ground situated in the town of Babylon, L. I., for Jacob M. Bergen, Esq., according to plans and specifications, and under the superintendence, of William H. Beers, architect, Tribune Building, New York city.

General Requirements.

The contractors to furnish all transportation, labor, materials, etc., for performing the work in the best manner, according to drawings and specification, and all work to be done in a thorough and workmanlike manner, to the true intent of drawings and specification, which are intended to include everything necessary to the proper and entire finishing of the carpenter's work, notwithstanding every item necessarily involved by the works is not particularly mentioned in specification. All work, when finished, to be delivered in a perfect and undamaged state, also clean out building at completion of the building.

Foundation.—The building will stand on locust posts, placed at the required distance between centers, and to be let into the earth four feet, with flat stones for them to stand on, and to be above ground as high as shown on elevation.

Timber to be of good quality, well seasoned, and free from bad imperfections.

Scantlings.—Main sill, 6″ × 6″, halved and pinned, spruce; plates, 4″ × 6″, spruce; posts, 4″ × 6″, spruce; girts, 1″ × 7″, spruce; braces, 3″ × 4″, spruce; door studs, 4″ × 4″, spruce; studding, 2″ × 4″, spruce; window studs, 3″ × 4″, spruce; floor beams, 2″ × 8″, placed 16′ on centers, spruce; girders, 4″ × 6″, spruce; stall partition plate, 5″ × 5′, spruce; stall posts, 5″ × 5″, turned yellow pine; rafters, 2″ × 6″, spruce; ridge, 1″ × 9″, spruce.

Framing.—The building to be all framed and braced and pinned in a substantial manner. Spike the beams strongly together wherever possible, to form a tie across the building.

Bridging.—All floors to be cross-bridged with 1″ × 4″ pieces cut and nailed with two nails to each piece.

Exterior Work.

Sheathing.—Cover the whole frame (except roof) with square-edged hemlock sheathing, laid with close joints, and well nailed to frame.

Clapboarding.—Put on best quality of clear, dry, white pine clapboards; cut close joints against all casings, etc.

Paper.—Cover the outside walls with the same quality of paper as used on house.

Outside Trimmings.—Corner boards, casings, etc., to be of the width as shown on drawings, 1¼ inches thick; all other trimmings to be as shown on drawings. All well seasoned white pine.

Shingles.—Where shown in gables, shingle with good quality of cedar shingles, with butts cut octagonal. Cover all the roofs with good quality 16 inch sawed white pine shingles, laid about 5½ inches to the weather.

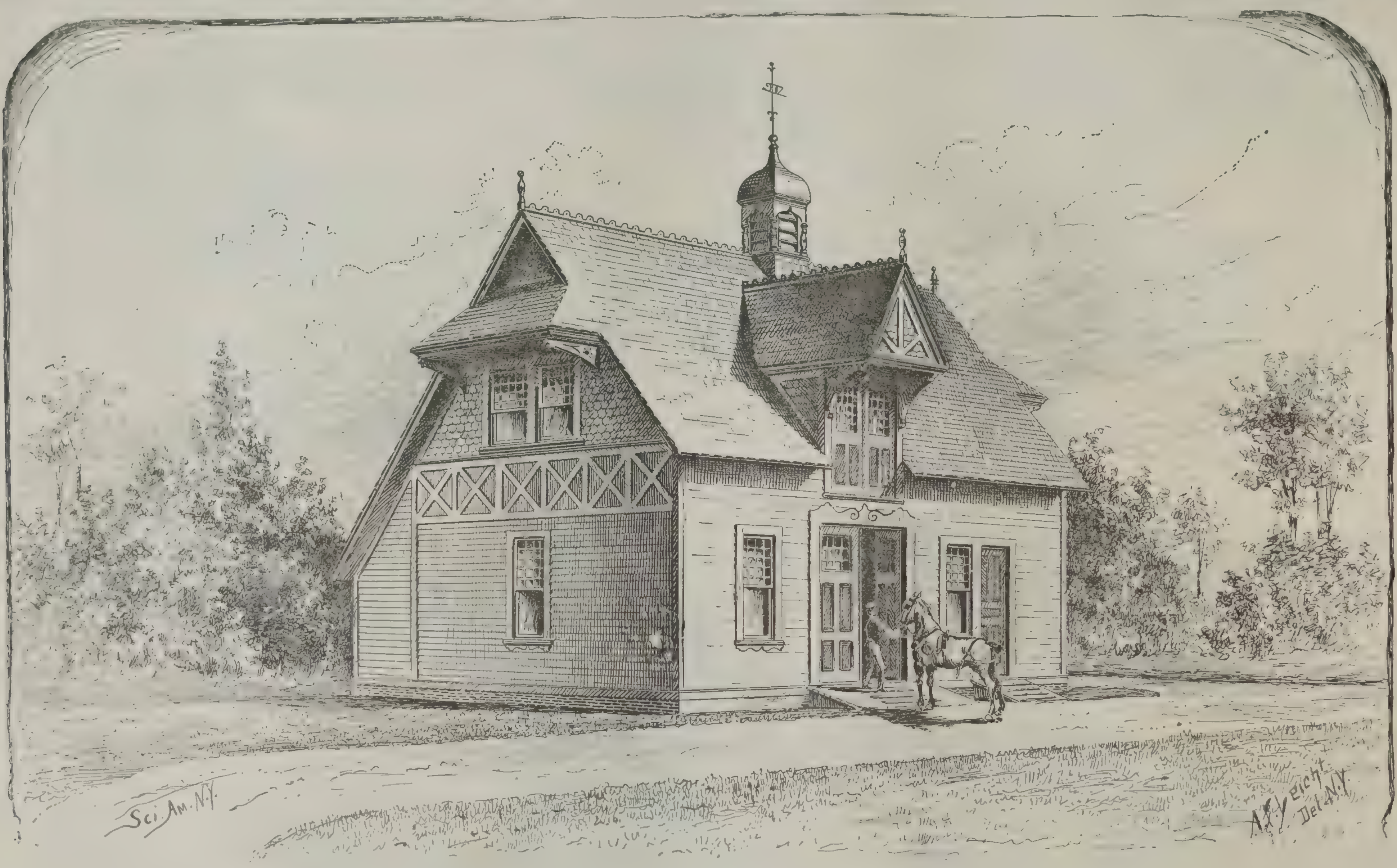
Glass.—All windows to be glazed with clear single thick sheet glass.

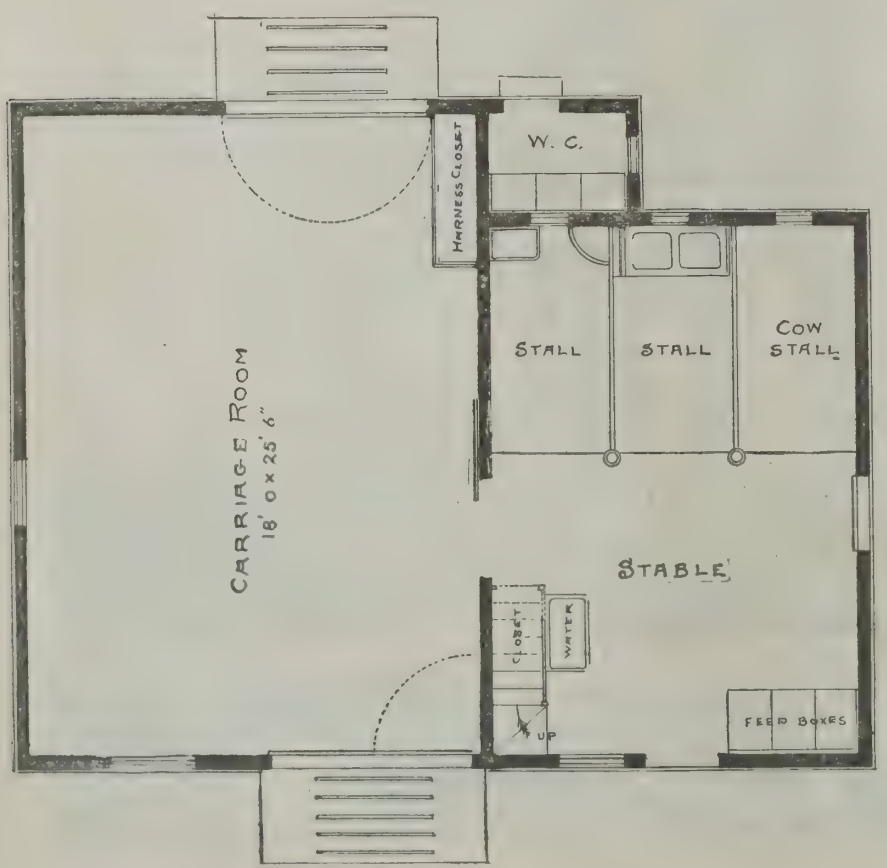
Priming.—The carpenter must call on painter to prime all work as soon as put up.

Interior Work.

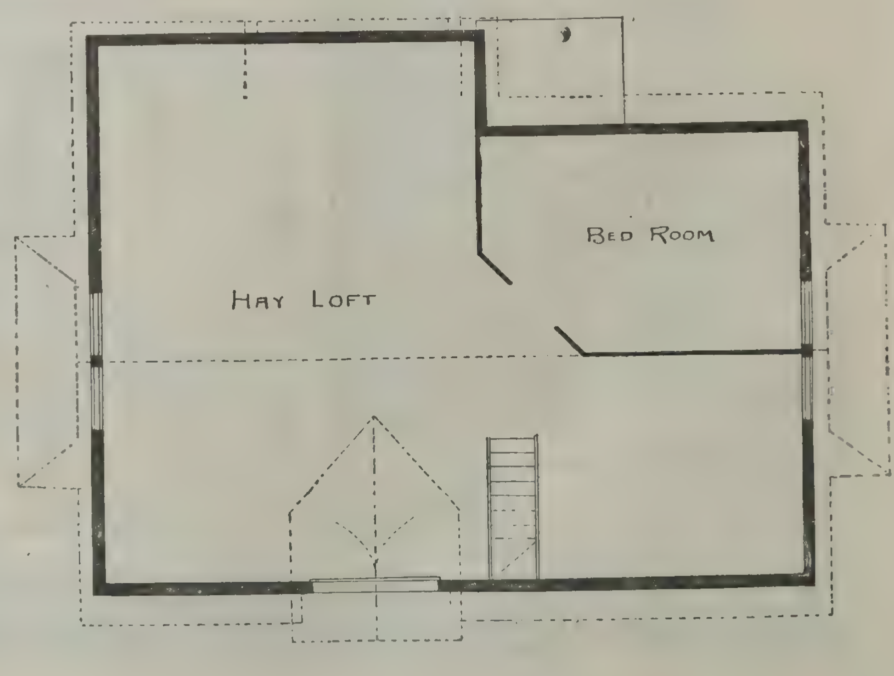
Lay a 2 inch tongued and grooved spruce floor on first story, free from any bad imperfections. Lay on second story a 1¼ inch tongued floor, all well nailed, and laid close to outside wall.

Stalls.—As shown on plan, build the necessary number of partitions for stalls of 2 inch yellow pine beaded





FIRST STORY.



SECOND STORY & ROOF PLAN.

A STABLE AT BABYLON, L. I.—WM. H. BEERS, NEW YORK, ARCHITECT.

stuff, with 5 inch turned posts at ends, and have iron ramp rail placed on top of each partition. Line walls out to the line of the door on ends and sides, and extend it to the ceiling with yellow pine, ⅞ inch thick and 4½ inches wide, all to be beaded. All the other walls and ceilings on first story will be left in the rough, except to put a plain trim on windows and doors. The stalls are to have a dirt floor, leveled off in the usual manner. The girders on which partitions of stalls rest to be thoroughly coated with coal tar before the stalls are filled in.

Stall Windows.—The stall windows to be made to slide, and must be protected by a strong galvanized iron wire, to prevent the glass being broken.

Stairs.—Build stairs as shown, of spruce, inclosed with narrow beaded stuff.

Man's Room.—Build partition around man's room loose joint butts, and to be secured with 4½ inch rim locks, with brown mineral knobs, trimmings japanned, with all the necessary keys, etc.

Large carriage room doors to have wrought iron door hinges.

Sliding Doors.—To be hung with patent hanging door sheaves. Secure these sliding doors with the proper size sliding door locks, also put bolts on carriage room doors, and all other hardware that may be needed.

Fit up harness closet with all the necessary harness hooks, etc.

Hay Racks, Mangers, etc.—The owner will furnish all hay racks, mangers, and water troughs, but to be put in by the carpenter.

Harness Closet.—Where shown, furnish and fit up a harness closet, with swinging doors, to have drawers

Outside Work.—Paint all outside work included in drawings three coats (except roof, which will have two coats) of best white lead and linseed oil; paint of such colors as the architect may direct, and all work, inside and out, must be to his entire satisfaction. All work to be left in a perfect state on completion of the job.

DESIGN FOR A DOUBLE HOUSE.

This design is intended to be carried out at a cost of about $2,800. The foundation walls are to be 16 inches thick, built of stone, and the cellar is to extend under one half the building only. The exterior is to be sheathed and covered with pine siding, with the gables finished in ornamental shingles. Roof over kitchen, all gutters and conductors best quality tin, and the main roof covered with best pine shingles. The inside finish to be of clear white pine, stairs yellow pine with cherry

DESIGN FOR A DOUBLE HOUSE.—BY N. KEIMIG, ATCHISON, KANSAS.

on walls, and partition and ceiling of tongued and grooved, beaded and scratched beaded spruce stuff.

Doors.—The large carriage room doors to be 2 inches thick; those on the north side to have one-half swing, and the other side slide back, to be hung from the top with barn door hangers. The door on the south side to have one side swing around against the other half, and then slide back both together, the swinging half to have a good size wheel roller on bottom of same, to make the door swing around without sagging. All other doors to be made as shown, 1½ inches thick. Door between carriage room and stable to slide, hung from the top, and to have four panels, and of same style as large carriage room doors.

Hardware.

All windows to have sash locks and sash pulleys, hemp line, weights, etc.

Locks, Butts, etc.—All inside and outside swinging doors on first and second stories to be hung with iron for blankets under, and to have a neatly moulded cornice on same.

Carriage Washer.—In the rear of building put a suitable sized lattice carriage washer, made of yellow pine strips, about 4½ inches wide and 1½ inches thick, and placed about ½ inch apart.

Painting.—Furnish all materials and perform all labor for the completion of all woodwork mentioned and required to be painted.

The materials to be the best of their several kinds, and all work to be done in a workmanlike manner. All lead and oil must be of the "Atlantic White Lead Company's" make. All woodwork must be thoroughly cleaned off, sandpapered, cracks and nail-holes stopped with putty, knots properly killed, and woodwork free from dirt and dust.

All finished woodwork to have one coat of oil and two coats of Crocker's varnish on first and second floors.

rail. Plastering three coats and painting two coats. Mantels in parlors to be of cherry. The height from floor to ceiling in cellar is 6 feet 4 inches, first floor 9 feet, and second floor 8 feet 3 inches.

Mr. N. Keimig, of Atchison, Kansas, is the author of the design.

Squaring Timber.

How easy it appears to the casual observer to square pieces say 3 inches square, or 3 inches each way; but a practical attempt will demonstrate that the square is far from being true. You then try to remedy the sides that are not square, and find that the other sides will be out of square, and at last come to the conclusion that the square is not at right angles, and the square is placed in the square shape. Another trial shows that the block is almost, but not quite, square. Try it once, and see if you can succeed in squaring a 3 inch piece of wood perfectly square.—*Carriage Monthly.*

DRAWING ROOM, HAMSTEAD, STAFFORDSHIRE.

This room has the internal woodwork of polished oak, the columns being of polished Devonshire marbles. It presents some suggestive features. John P. Osborne, architect, Birmingham.—*The Architect.*

Australian Timber.

The karri is of great size, exceeding 300 ft. in height, and a specimen is known 60 ft. in circumference at the base, and free from branches 100 ft. up. Like jarrah, karri has been exported.

The white gum, which produces a timber of a lighter color, grows in most of the forests excepting those occupied by the karri, which appears inimical to it. It is not so large a tree as the karri, but has been found 17 ft. in diameter. In height it rarely exceeds 120 ft. The timber is suited for cart shafts and wheelwrights' work generally, being hard and durable, and, though difficult to work, it is considered the best for such purposes in the colony. Its specific gravity is high, the weight of a cubic foot being often 70 lb.

Tooart is a specially strong timber, and shrinks little in seasoning and does not split in the process. It is very durable and tough, and suited for heavy and strong carpentry, underframing of railway vehicles and hatchcombing. It is very curly and twisted in the grain.

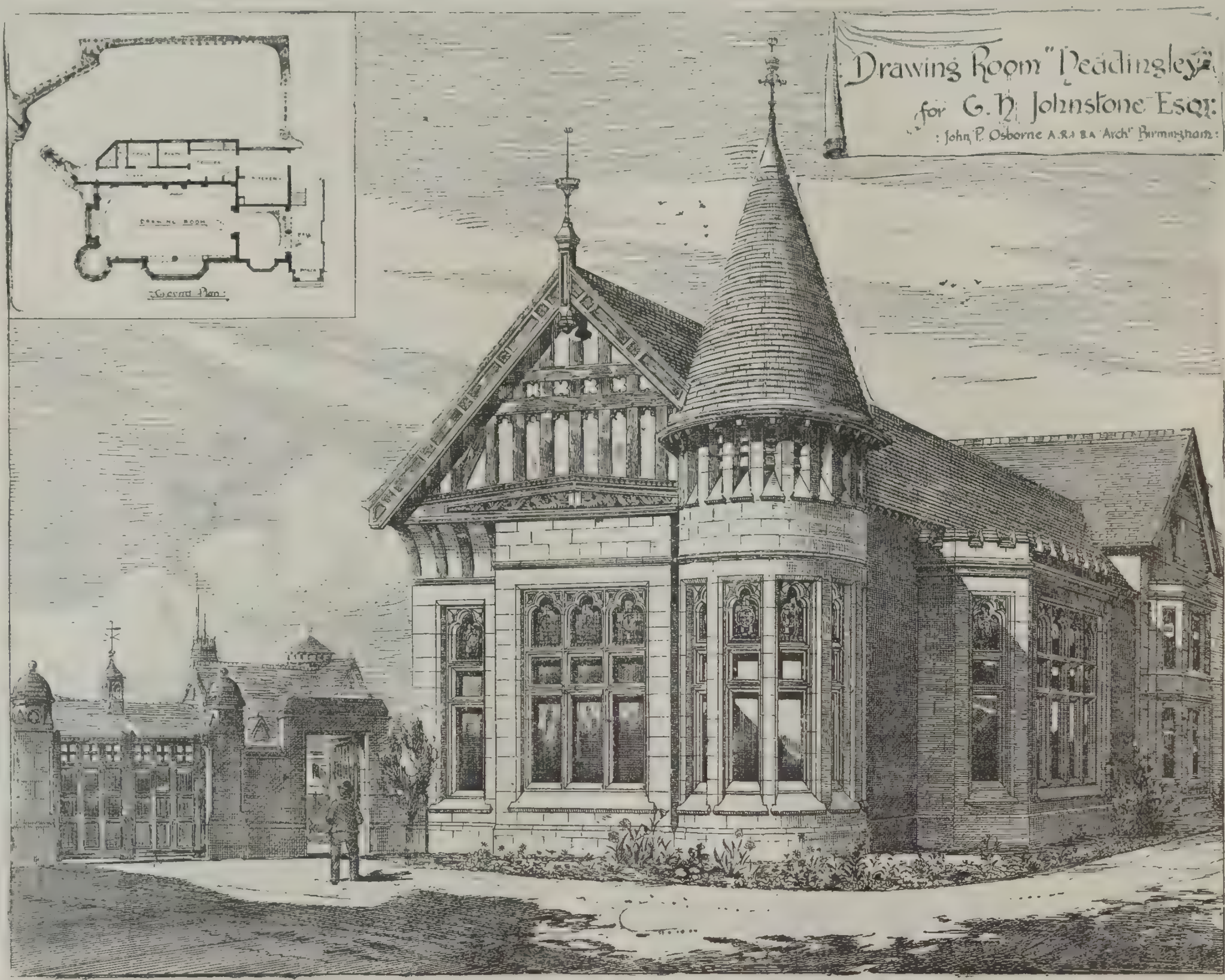
The York gum, though not much exported, is much used in the colony for the naves and felloes of wheels, for which purpose it is said that it should be steam seasoned.

The red gum is a shade tree of 40 to 50 ft. in height, yielding a valuable gum, worth £25 per ton. It is not much used as a timber tree, as it is not very durable, and does not resist the white ant. As an ornamental tree it is in request, and is stated as cooling the atmosphere and being healthy to live among, and of very rapid growth. The blue gum tree (*Eucalyptus megacarpa*) of Western Australia must not be confounded with the blue gum tree of Tasmania and Victoria (*Eucalyptus globulus*), never attaining the size of that species, seldom exceeding 100 ft in height, and differing also in its floral characters and fruit. Little is known of its timber.

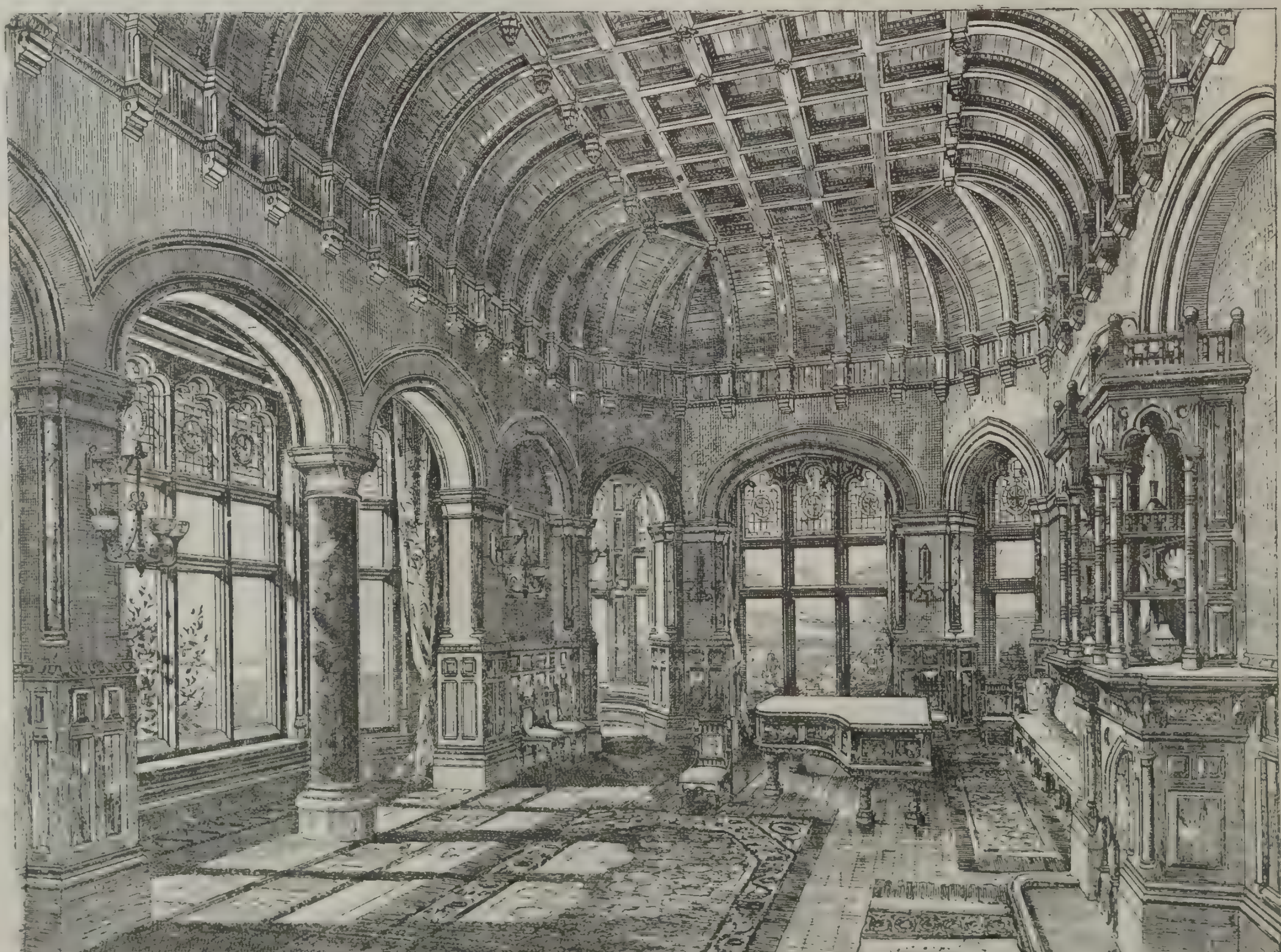
Besides the species enumerated, several other *Eucalypti* pass in Western Australia under vernacular names. Thus, *Eucalyptus patrus* is the blackbutt tree; spearwood is the *Eucalyptus doratoxylon;* and other well-known species pass as bloodwood trees, stringy bark, box.

The various species of *Eucalyptus* form by no means the whole of the timber trees of Western Australia. Of trees not *Eucalypts*, those of the *casuarina* species are the most important, and next come the acacias. Some of these produce woods hard and durable, suited for furniture and implements; others are soft, and suited for house joinery purposes, while many owe their value to their ornamental appearance. In time, however, as the country becomes more settled, the value of the various trees will become better known.

There are certain conspicuous ingredients of the *Eucalyptus* wood, irrespective of such substances as are found in all woods, that distinguish it specially from other timbers These are kino-tannic acid, a substance readily soluble in water and alcohol, and a closely allied pigment, known as phlobaphen, which is soluble only in alkaline liquids, from which neutralization by acid again precipitates it. It is this phlobaphen which appears to give the powers of resistance to decay. It is the fact, also, of this substance being fully elaborated in the pores of the wood at the end of the summer season that renders the timber felled at that period the best.



AN ENGLISH DRAWING ROOM.—EXTERIOR VIEW.



AN ENGLISH DRAWING ROOM.—POLISHED OAK AND POLISHED MARBLE.

Blue Lias Lime in Mortar.

Blue lias lime will not make good mortar if mixed with more than two cubic feet of sand to one of lime. This opinion, first formed by me from analogy, and in consideration of the blue lias approaching very nearly to a water cement, proved on due inquiry to be borne out by, and exactly conformable to, the practice of the masons of Lyme Regis. But Captain Savage, of the Royal Engineers, who was employed professionally some years ago in improving the cobb or pier of that little seaport, which was done by tide work, and in which no other kind of lime was used, assured me that he found that a smaller proportion of sand than two to one made still better mortar. We have since ascertained by repeated experiments at Chatham that one cubic foot of blue lias lime from the kiln, weighing 47 lb., mixed with two cubic feet of sand and about three quarters of a cubic foot of water, made mortar fit for use, but which could not have borne more sand without becoming too short. The average quantity produced was two cubic feet and one-fifth, which, contrary to the result obtained with the purer limes, occupied more space than the sand alone originally did. We found also that blue lias lime from the kiln, like all the other limes that we experimented upon, filled only about two-thirds of its original measure, when reduced by pounding to the state of quicklime powder; but one cubic foot of blue lias lime, when slaked, only dilated into one cubic foot and a third of slaked lime powder, not including about one-eighteenth part of a cubic foot of core, which we threw away. —*Sir C. W. Pasley, R.E.*

THE best female lacemakers in Saxony are not able to earn more than sixty cents a week.

THE PRINCIPAL FRONT OF THE CATHEDRAL OF TARRAGONA.

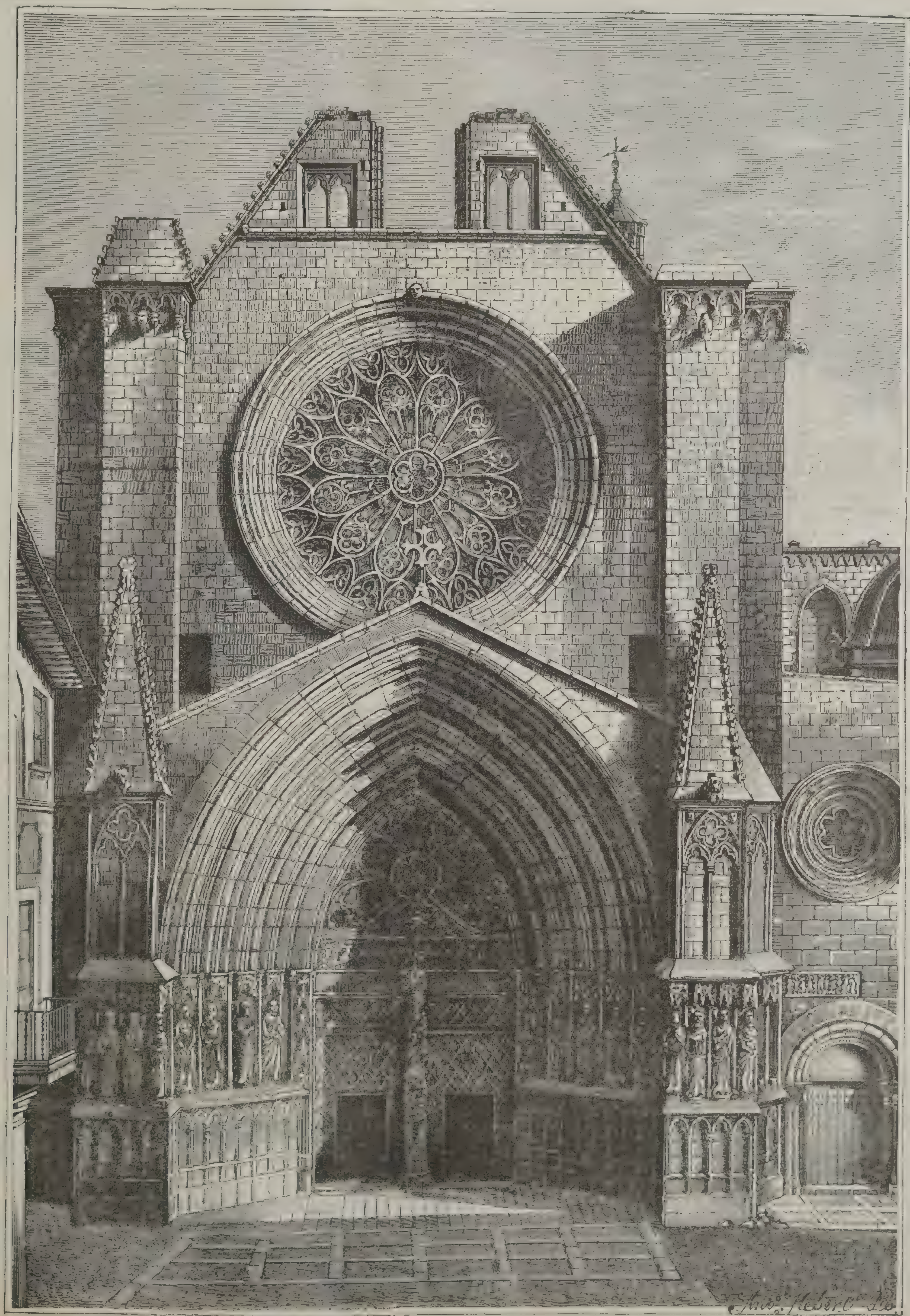
The name of the first architect or master of this sumptuous edifice has been lost, as well as others of the great Spanish artists. But if tradition rightly sanctifies his memory, he was called San Hipolito. The second master of the work was Frial Bernardo, who died in 1256.

The third master, Bartolome, worked in 1278, and in the last third of the fourteenth century Bernardo Dballfogona directed the works, succeeding thereto, afterward, famous architects and sculptors, such as Wm. De la Mota, Francisco Gomar, James Amigo, Bernardo Casares, Peter Blay, and others. The facade is most beautiful, and is not even yet completed, as our readers may see from the engraving, which is from a drawing by Antonio Hebert. It consists of three sections, and belongs to the style of Ojival.

The first is the doorway, which is formed with two broad pillars terminating in pyramids, and between them rises the arcade, in whose niches there are statues of apostles and prophets, and above whose heads canopies are arranged. The central doorway is composed of three grand compositions of marble, and is divided in two parts by a pillar, which supports the statue of the Virgin, with Jesus in her arms. Bass-reliefs and rich works decorate and enrich them, and immediately above is a magnificent window, of open and airy design.

The second part is formed with square pillars with beautiful ornaments and relief, while between them there appears conspicuously the great circular rose window, one of the most beautiful and elegant that Christian art presents, resembling those of the cathedrals of Burgos and Seville.

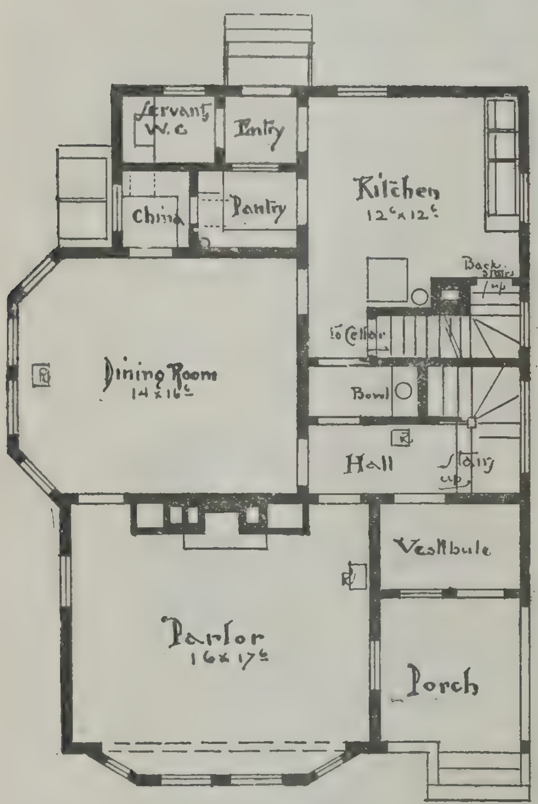
The third part remains unfinished, owing to the decline of the renaissance since the year 1507. This cathedral has been made the subject for complete restoration by the Barcelonese architects Ellias Rogent and Augusto Font.—*La Ilustracion.*



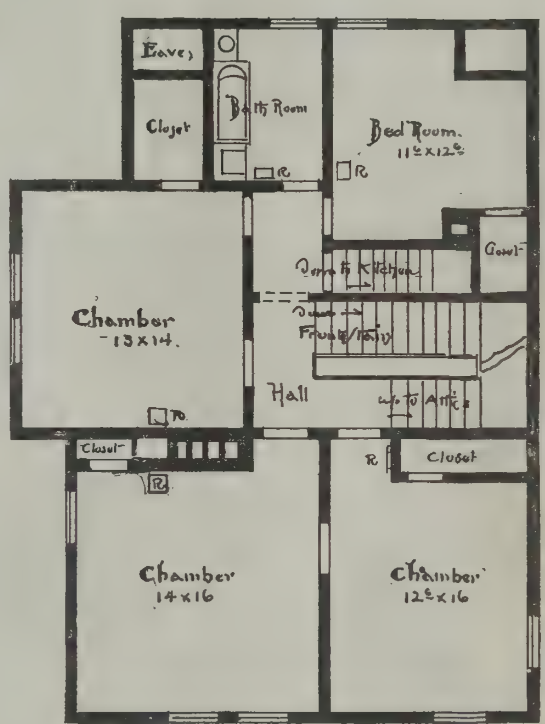
CATHEDRAL OF TARRAGONA, SPAIN.—PRINCIPAL FRONT.

Side Elevation.

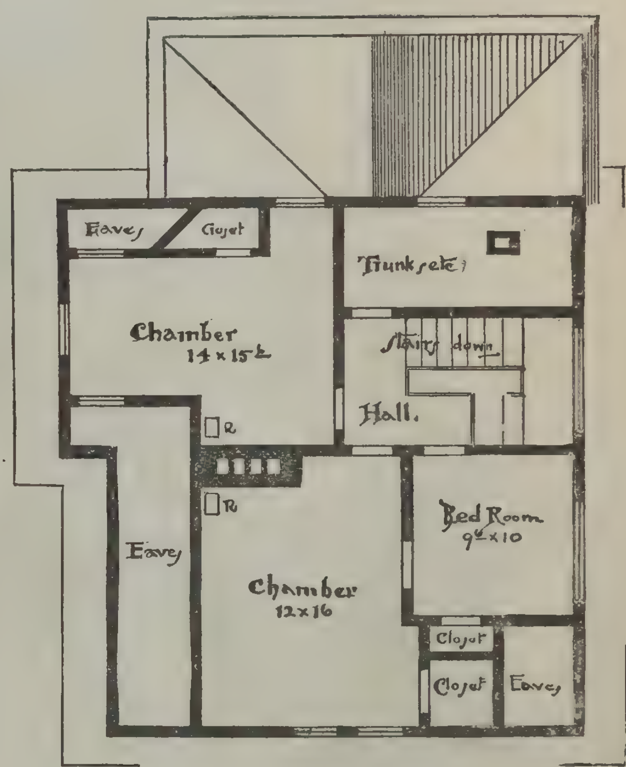
Front Elevation.



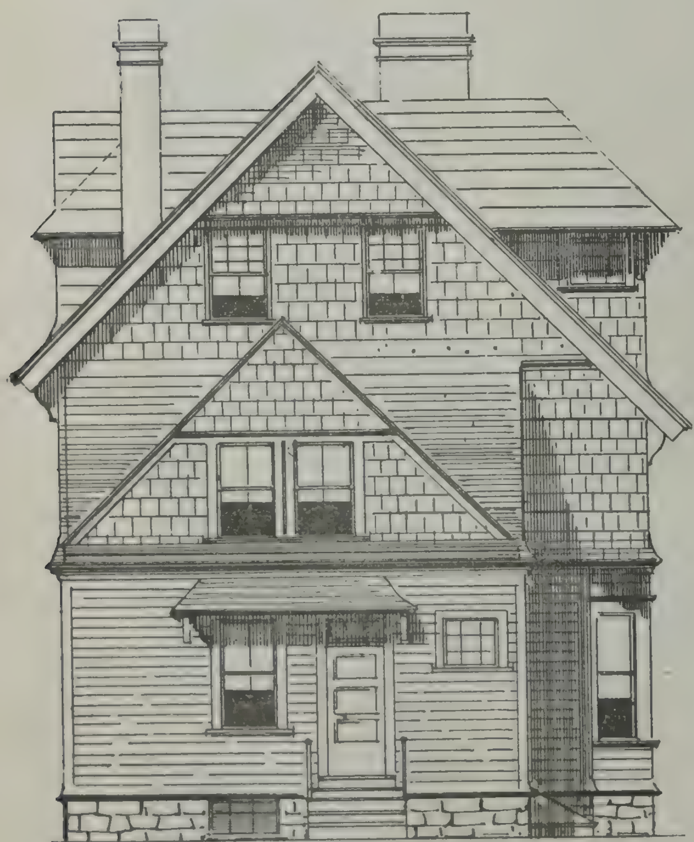
First Floor



Second Floor



Attic Floor



Rear Elevation.

Side Elevation

DESIGN FOR A DWELLING COSTING $4,000.—FRANK H. SHEPHERD, ARCHITECT, BOSTON, MASS.

A DESIGN FOR A COUNTRY HOUSE COSTING $4,000.

FRANK H. SHEPHERD, ARCHITECT, 19 PEARL ST., BOSTON.

This house contains ten rooms, bath, pantry, china, store rooms, and servants' water closet, soapstone set tubs and sink in kitchen

First and second floors are finished in whitewood; upper floor, pine painted. Exterior—clapboards on the first story, cedar shingles dipped in Cabot's stain (three shades) above.

Furnace, hardware, gas fixtures (brass), and papering of the best quality.

Cellar has cemented floor and is ceiled.

Build in a thorough manner and ready for occupancy.

THE ROSE POLYTECHNIC INSTITUTE.

This institute of technology, founded in 1874 by the late Chauncey Rose, of Terre Haute, was opened March 7, 1883.

The founder made the institute his residuary legatee, and it is impossible to determine the exact amount to be derived from the estate; but it is reasonable to estimate the aggregate of his donations to the school at a sum considerably exceeding $500,000.

This Polytechnic School, in undertaking to fit young men for the proper discharge of the duties of engineers, teaches the principles and the practice of engineering with special reference to the following branches of the subject: Mechanical engineering, civil engineering, chemistry, physics, and drawing.

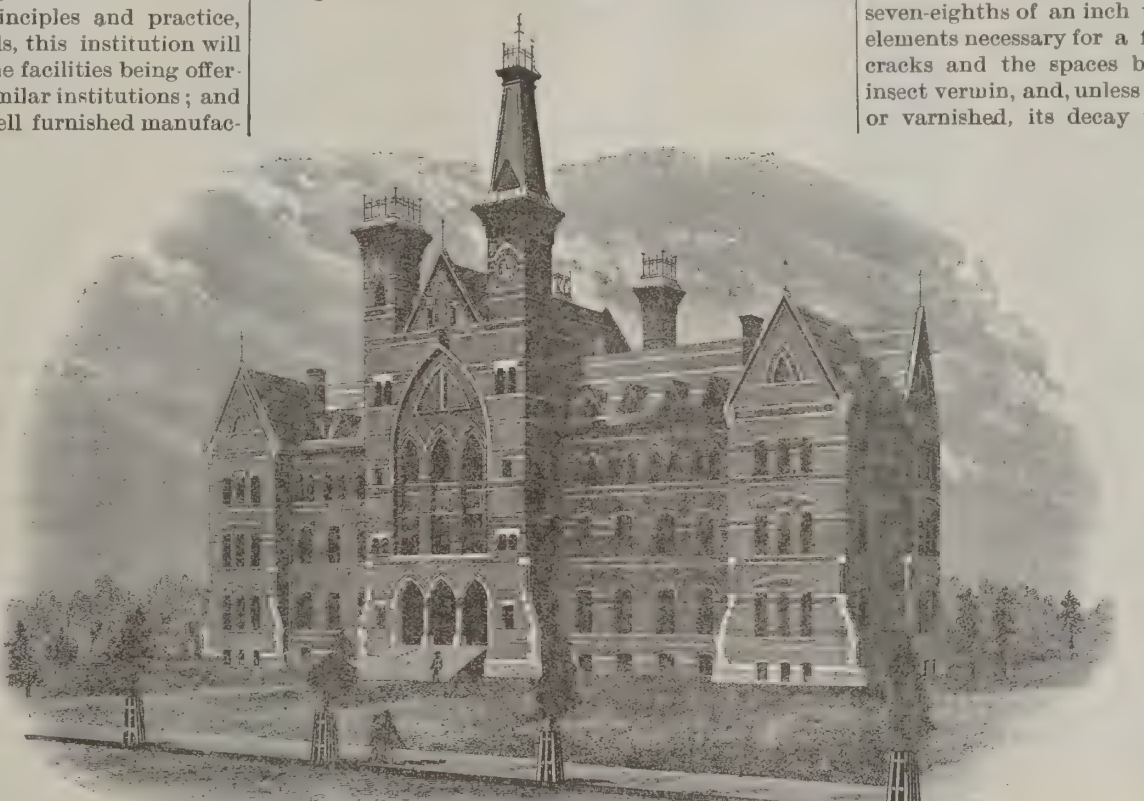
In resources for teaching principles and practice, whether of men or of materials, this institution will not be easily surpassed, the same facilities being offered here that are offered in all similar institutions; and in mechanical engineering, a well furnished manufacturing machine shop is a unique and valuable feature of this school.

The idea of combining manual training in a manufacturing shop with the study of principles, first brought out at the Worcester Free Institute, has been found both practical and useful; practice accompanies and illustrates theory; the academy inspires its intelligence into the work of the shop, and the shop, with eyes open to the improvement of productive industries, prevents the monastic dreams and shortness of vision that sometimes paralyze the profound learning of the college.

The important fact which underlies any sound scheme for school shops is that machinery is to have a constantly increasing share in the conversion of matter into useful form. The educated mechanic must understand the practical limits of mechanical production and all the possible ways in which those limits can be extended. He must know by practice how to design, construct, and assemble the parts of a machine, as well as how to finish its product by skillful handicraft, and he should also know how to make his tools. The power of an engineer to decide, upon general grounds, the best form and material for a machine, and to calculate its parts, is vastly increased by blending with it the skill of the craftsman in manipulating the material.

The shops constitute a manufacturing establishment, so that the students can see good work done as well as do it themselves. A satisfactory variety of work is obtained by contracts, the highest standard of workmanship is maintained, and the best obtainable tools and machinery are used.

The work of the students is so distributed that they spend twenty-four hours per week in the shop during the first year, and ten hours a week during the rest of the course.



ROSE POLYTECHNIC INSTITUTE.

Some Needed Improvements in Modern Dwellings.

Under the above heading our valued contributor, Mr. W. N. Lockington, of Philadelphia, writes some very sensible remarks to the columns of the *American*, which we take pleasure in reproducing in full:

"The modern house, even that of the rich, is not what it ought to be. Architects and builders are both behind the times. The traditions of style and those of the builders' trade are alike inimical to progress in house building. The architecture of the Egyptian, Greek, and even Roman, was in its way perfect, for the architects of those days builded the best they knew; their dwellings, temples, and public buildings reflected the knowledge of the age. It is not thus now. We are but just commencing to apply the great discoveries of our century in such a way as to increase the comfort of our homes, and we have not yet learned to pick from the works of our predecessors just what is suitable to our own wants, and let the rest go. What is called style, that is to say, a mode which was suited to the wants of some bygone age, is still allowed to override comfort and convenience, while our artist-architects are willing to sacrifice everything to their own individual ideas of the picturesque. On the other hand, our builders and builder-architects, the men of figures and practice, work in the ruts worn by their fathers, and are exceedingly slow to venture upon improvements.

Our houses, both in plan and construction, are full of what an ethnologist denominates "survivals." The roofs are steep and obstructed with dormers, gutters, and various devices for retaining snow, causing chimneys to smoke and favoring the accumulation of soot and other impurities; and all because our ancestors were in the habit of building their houses with steep roofs and quaint projections. The joists of our floors are placed on edge, leaving between them spaces which not only facilitate combustion, but harbor vermin and impurities of all sorts. A stick of timber is of course stronger to bear a weight when placed on edge, but since the spaces between the joints must be bridged across before the floor is perfect, it would be far better to lay the joists flat and close together. It is well known that damp is best kept out by a hollow wall, and there are methods by which the hollow wall can be bonded so efficiently that it is practically as strong as or even stronger than a solid wall containing the same quantity of material; but architects seldom specify hollow walls (save in a basement), builders ignore them, and masons and bricklayers do not know how to construct them. So that instead we have the inevitable furring strip and lathing, adding two inches to the thickness of the wall, and by no means keeping out the damp, though it may prevent it from spoiling the plastering and paper.

What with the spaces between joists and rafters, those between the lathing and the stone or brick walls, and those which separate the studs of our partitions, we provide a vast interior continuous network of commodious abiding places for rats, mice, roaches, and other vermin; we give them homes where they are secure alike from cat, poison, and insect powder, and where their excrement and their dead bodies may rot peacefully near to our noses.

There is at present considerable agitation upon the subject of sanitary plumbing, and doubtless many people believe that, when their houses have the best of piping and newest of traps and water closet apparatus, they need fear nothing. There is no question that good plumbing is a boon, but security from sewer gas and filth diseases cannot be attained by the resources of the plumber's art. All his appliances are as yet imperfect, and health can be better insured by placing bath rooms and water closets in such positions that they are practically isolated from the rest of the house, and are self-ventilating, than by all the complexities of traps and vents. The ordinary practice of providing a bath room with a water closet, often the only one in the house, is a barbarity worthy of mediæval times. We go, or we ought to go, to the bath for cleanliness and purity, and it is abominable to place in that bath room the outlet of a reservoir of impurity. The closet may be handy, but ought to be separate, with its own window and entrance lobby. The windows of bath rooms and water closets should be as large as possible, and should reach to the ceiling. Movable blinds can readily be made to screen the inmates. Closets, sinks, and all appliances needing plumbing, should be placed as nearly as possible over each other, and should be confined to one part of the house. Nothing of the kind should, under any pretense, be tolerated in or very near sitting rooms or bed rooms, for the best of plumbing may at any time get out of order, and the less there is of it the better. The family whose bath rooms and water closets are separated from the house by a corridor or piazza open to the weather will, other things equal, be more healthy than the family which has these necessities close to the living rooms.

What is known as a damp course, that is, a layer of some impervious material running around the walls of the house just above the ground line, is an old preventive against the rise of damp. But our builders are not in the habit of using it, neither do they, as a rule, build even the walls of the basement hollow. Hence most basements exhibit walls which are damp inside, and this damp spreads upward to the ground floor.

It is the prevailing fashion to use a great quantity of woodwork in interior decoration. Wainscoting, cornices, architraves, are of wood, often the ceiling is paneled in the same material, and the wainscoting not seldom reaches almost or quite to the ceiling. It cannot be disputed that some very pretty effects are thus produced, and that a modern house may in this manner be made to simulate one of the fifteenth or sixteenth century. But the woodwork lacks the substantiality of the work it simulates. It is usually seven-eighths of an inch thick, and furnishes all the elements necessary for a first-class conflagration. Its cracks and the spaces behind it are receptacles for insect vermin, and, unless kept thoroughly well painted or varnished, its decay from damp or dry rot is a menace to health. There is no reason for so much woodwork. Cement and tiles, plaster, carton-pierre, glazed bricks, and terra cotta can be made to produce effects equally striking; and even veneerings of marble are not much more costly than woodwork is often made to be.

The loss of the roof is perhaps the greatest shortcoming of the modern house. Without additional expense save for the staircase or elevator, and the surrounding balustrade, our roofs might be made the evening promenades and summer gardens of the entire population. The air at this higher level is purer than below, and if any breeze is stirring, it will certainly make itself felt there. Instead of the confined area of a back yard, fed with odors from sewer and cesspool, every family would be provided with a promenade equal in area to the floor below. Those possessed of taste and wealth could adorn the flat roofs with plants grown in pots or tubs, with kiosks and summer houses, with hothouses and conservatories. The front entrance steps, now the only evening resort of the Philadelphian, would be abandoned, for neighbors could converse and visit by way of the roof. This free access to the sky floor would not only afford security against any conflagration which might break out in the lower floors, but would redeem the roofs from the burglar and tom cat, who are sole prowlers in the now desert region.

Let us have, then, together with the latest improvements in plumbing, electrical, pneumatic, and hydraulic appliances, or even without these things, some houses which shall have flat roofs readily accessible; solid floors; hollow and well built exterior walls; closets and bath rooms separate from each other, and as far removed as possible from the living rooms; good plumbing and little of it; properly constructed basements; interior decoration of cement or tiles or other mineral substances; and partitions of vertical planks or slabs of lime or baked clay."

Paris to be a Seaport.

The Manchester Ship Canal has given rise to a project for making Paris a port, and enabling it to be as independent of Rouen as Manchester expects to be of Liverpool. It is estimated that the canalization of the Seine, with other works in connection, would cost about $22,500,000. There are only two places in which it would be necessary to deviate from the course of the river. It is also supposed that vessels drawing nearly 20 feet of water could reach the capital. The project has been supported by an admiral, who has presented a memorial on the subject to the Minister of Public Works. It is supposed there will be little difficulty in obtaining the capital.

A PROPOSED 820-FOOT TOWER.

Among the projects for a 984-foot tower that have not been examined by the official committee on the Paris Exposition of 1889, there is a new one by Mr. Bourdais, of which the principle may be defined thus: Shape cylindrical, framework of iron set into the earth, covering of copper, base of stone.

Location.—A very high monument, which is to overlook not only Paris, but several surrounding departments, ought, as it seems to Mr. Bourdais, to be built upon elevated ground; and he proposes to select Trocadero Square, which is 52 feet above the Champ de Mars, and which, for the same level at the top of the monument, would permit of giving the latter a height of but 900 feet. Trocadero Square is the center of seven radiating avenues, and is also in the very axis of the boulevard embraced between Drouot Street and the Madeleine. The colossal structure would therefore be seen from the most frequented part of the center of Paris. It is well to recall the fact that for these two reasons of direction and altitude, Mr. Alphaud, about twenty-five years ago, proposed to erect in this same spot a triumphal column to the glory of our army. It is likewise a column that Mr. Bourdais proposes to erect there.

Character of the Monument.—To erect a monument 984 feet in height, for the sole purpose of looking afar off toward the horizon, might appear to be a narrow object, in view of the expense to be incurred. It would seem that such a structure, unique by reason of its dimensions, ought to be so also by reason of its monumental character and probable duration; and if the great centennial fete is to serve for its inauguration, it seems indicated that this monument is to worthily perpetuate the memory of the same. Consequently, it ought to borrow from the two artistic manifestations of French genius—painting and sculpture. If, for example, on the faces of a stone base there were left four wide spaces capable of receiving, either in mosaic or fresco work, the principal scenes of the French revolution; if, in an elevated frieze, sculpture should represent the chief persons of that epoch; and if the monument should be crowned with a statue of Liberty, a much more interesting object would evidently be attained than that of ascending to a great height.

Methods of Ascending.—Mr. Bourdais' project comprises a central shaft of a uniform diameter from base to summit, and consequently permitting of applying those modes of ascending to great heights that have already been tested from the standpoints of velocity, cheapness, and perfect safety. Ascending obliquely at a steep gradient has never been tried yet, and it would perhaps be imprudent to test it on so large a scale before experiment has proved its perfect security. Morever, it appears to be absolutely indispensable that the elevator car shall be in a covered place and under shelter from wind, rain, and snow. The upper platform should possess a wide area, to allow a very large number of persons to remain there with ease. Mr. Bourdais' platform would have a superficies of over three hundred and fifty square yards, so as to accommodate about 1,000 persons coming up per hour.

Location of the Motors.—As the elevators cannot be run without motors, it is necessary to look out for a situation for the latter, and to provide for the disposal of the smoke of the coal or coke used as fuel. It should be foreseen, too, that electric machines will be necessary.

Dimensions to be Adopted.—By constructing a monument 787 feet in height upon Trocadero Square, which has an elevation of 197 feet, we should reach a total altitude of 984 feet, and have a very high edifice, that would appear in proportion with the palace of the Trocadero. As for the view of the horizon, the projector thinks that that would not be sensibly diminished, since at such heights the horizon is of a gray aspect, and not interesting beyond a certain limit.

Duration.—In order to secure an unlimited duration of the monument, Mr. Bourdais proposes to invest the entire external metallic part with sheet copper, 0·06 of an inch in thickness.

Calculations of Resistance.—The metallic framework would consist of a steel tube having an internal diameter of 36 feet, and the sides of which would be 6½ feet thick at the base, and diminish to 1½ foot at the summit. This tube or shaft would be surmounted by a pyramid, having eight sides at the upper part. At the bottom it would be strengthened, to a height of 165 feet, by a cone 75 feet in diameter, while eight supplementary ribs would add to the solidity of the whole. The forces that would enter into play would be the weight of the structure and the action of the wind.

It is easy to calculate the moments of flexion at every point of the tube's section. The projector has done this for all the principal points, and has traced a representative figure of such moments for the entire height of the column. He has thus found a maximum moment at the base expressed by 198,718,520 lb., supposing that the masonry that invests the base shields the metallic part against the action of the wind. If, *a priori*, we suppose that the parts of the column, as a whole, will weigh 11,000,000 lb., it will be seen that, near the earth, the tube will undergo three different actions, viz., (1) a flexion expressed by 197,718,520 lb.; (2) a compression of 11,000,000 lb.; and (3) a positive stress of 1,133,000 lb.

The section of the tube at the base would consist of 16 internal uprights, each having a superficies of 56 square inches, and 16 external arcs, with a superficies of 155 square inches each.

Upon referring to the section in Fig. 2, it will be seen that the total weight of 11,000,000 lb. would rest chiefly upon the internal uprights, situated on the vertical of the principal weights. Upon the external uprights would rest the decorative shell and the flooring. The central tube would rise alone, and would comprise 16 uprights, each having a section, at 150 feet from the ground, of 155 square inches, inclusive of the copper sheathing. Under the cap the uprights would each have a section of 46 square inches, inclusive of the sheathing.

The estimated total cost is $1,200,000. Were the project deprived of its decorative portion in masonry and copper, and thus reduced to a simple metallic carcass, occupying a superficial area of less than 1,500 feet (a circle 82 feet in diameter), the cost would be reduced to $600,000.—*Le Genie Civil.*

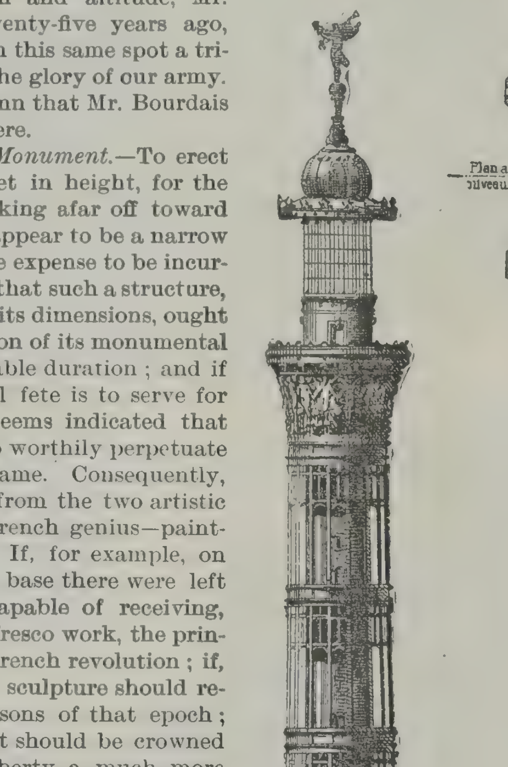


Fig. 1.—A PROJECTED TOWER 820 FEET IN HEIGHT.

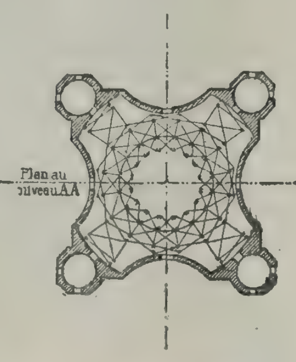


Fig. 3.—PLAN.

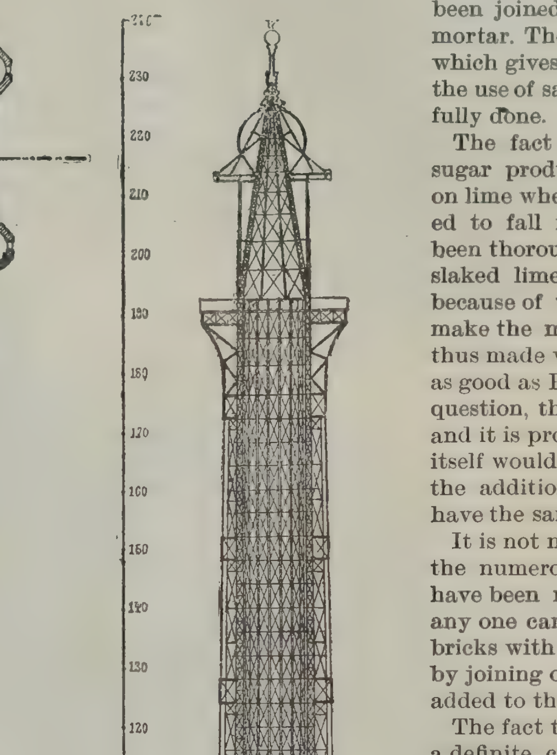


Fig. 2.—VERTICAL SECTION.

Sugar in Mortar.

The following curious communication from Mr. Thomson Hankey has appeared in the London *Times:*

My attention has been called by a gentleman well known in the scientific world to a new use for sugar, which, at the present low price of that article, might be capable of being practically applied.

Experiments have recently been made proving that sugar is a valuable ingredient in mortar and cement, having strong binding qualities. Equal quantities of finely powdered lime of a very common kind were mixed with an equal quantity of good brown sugar, with the addition of water, and the result was a cement of exceptional strength. This has been tried at Peterborough Cathedral, two large pieces of stone of the broken tracery of a window having been joined firmly together by sugared mortar. The severest test is joining glass, which gives no hold to mortar without the use of sand, and this has been successfully done.

The fact appears to be certain that sugar produces an extraordinary effect on lime when the latter has been allowed to fall into a fine powder and has been thoroughly slaked. Particles of unslaked lime would destroy the result, because of their expansion, which would make the mortar lift. The sugar mortar thus made will be found, I believe, to be as good as Portland cement, and the only question, therefore, would be one of cost; and it is probable that Portland cement itself would be made much stronger by the addition of sugar. Treacle might have the same effect.

It is not necessary to mention in detail the numerous small experiments which have been made. It is a matter which any one can test for himself by joining bricks with Portland cement alone, and by joining others with sugar and water added to the cement.

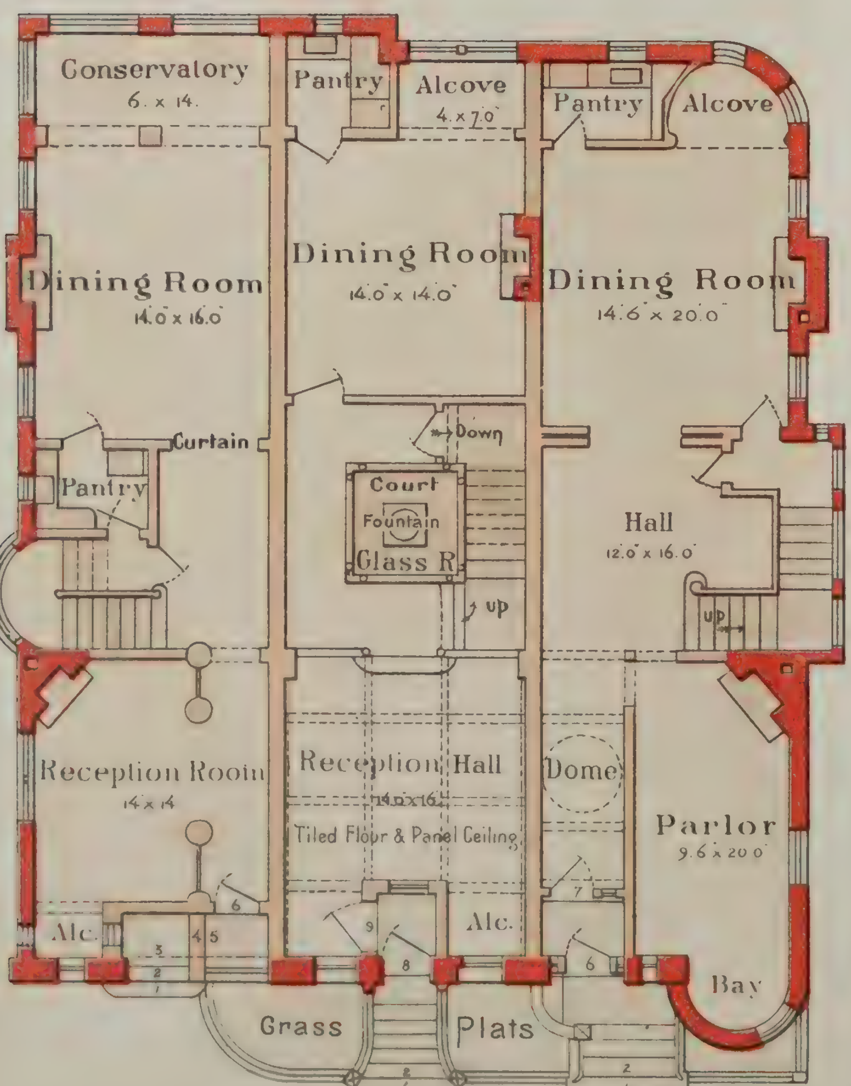
The fact that cane sugar and lime form a definite chemical compound has long been known. It is used, indeed, for various purposes, and it may be hoped that the suggestion for its use as an ingredient in mortar may be turned to practical account by builders and cement manufacturers. It has been suggested to me that the use of sugar is the secret of the success of the old Roman mortar.

Expansion of Concrete.

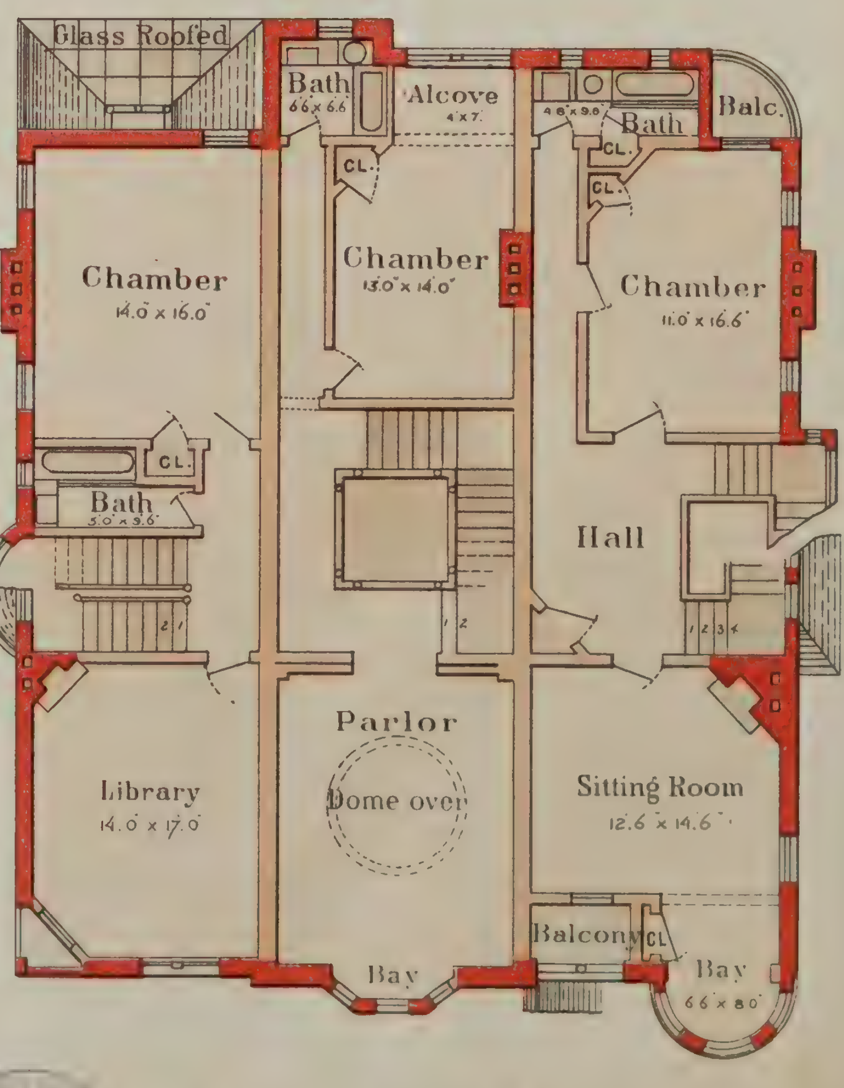
Some experiments on the expansion of concrete proved to me that it varies a little with the season of the year. In hot summer weather the expansion of a cubic foot in twenty-four hours after mixing was as much as one thirtieth of its bulk, usually one thirty-second; but in frosty weather it rarely exceeded one forty-eighth. The force exerted in the expansion was always sufficient to burst the box in which the concrete had been deposited; the amount might even be measured by the distance the nails were drawn out. Whenever the expansion exceeded one-thirtieth of the bulk, I considered the concrete too rich in lime, and that there was more than would, when slaked, fill up the interstices of the sand and flints, and coat each grain with a thin pellicle of lime. More than this is not required, for too thick a coating of lime causes weakness, and not strength.—*G. Robertson.*

· A Block of Brick Dwellings of Moderate Cost ·

W. Claude Frederic, Architect, Baltimore, Md.



Plan of First Floor.



Plan of Second Floor.

· A COTTAGE OF MODERATE COST ·

H. G. KNAPP & Co., Architects, N.Y.

Plan of First Floor.

Plan of Second Floor.

Fireproofing Wood.

A mode of rendering wood incombustible not generally known is described as follows: Soak 27·5 parts by weight of sulphate of zinc, 11 of potash, 22 of alum, and 11 of manganic oxide in lukewarm water in an iron boiler, and gradually add 11 parts by weight of 60 per cent sulphuric acid. The wood to be prepared is placed upon an iron grating in an apparatus of suitable size, the separate pieces being placed at least an inch apart. The liquid is then poured into the apparatus and the wood allowed to remain completely covered for three hours, and is then air dried. The mode of application described is, we fear, a serious obstacle to the general use of this process for timber employed in building, especially as the rough timber, before being worked or framed, could only be conveniently treated in this manner. If joists, ceiling beams, and all joinery exposed to fire could be treated after being fixed with some chemical solution of proved resistance to the action of flame, we believe many architects would be found to employ it.

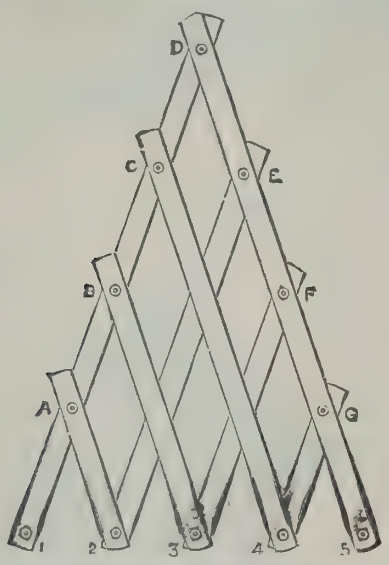
ARCHITECTURAL SKETCHES.—SEVILLE, SPAIN.

FORGED TRELLISES.

At the period called by the Germans the "*Barockzeit*," when the style of decoration involved a mixture of the German, Italian, and French renaissance, about the year 1700, when the art of the blacksmith reached its highest development, were constructed many beautiful and remarkable works of art, still to be found in many places; such examples including railings for vestibules of churches and cloisters, cemetery gates, and the like. The two elegant examples of terminals of railings shown in the cut occur in a private house in Halle, and are to be commended for their correctness of style.—*Die Metallarbeiter.*

A PANTOGRAPH.

Three different sized copies of a drawing can be made at the same time by the help of a pantograph constructed according to the plan shown in the accompanying illustration. I need not give any dimensions, but care must be taken to place all the strips sloping one way uppermost, and all those sloping the other way undermost, and the hinges at A, B, C and E, F, G at equal distances, so that the bars, D 1 and D 5, are divided into four equal parts. In working the pantograph, if the pivot is fixed at 1, and the tracer at 5, and the pencils at 2, 3, and 4, the copies produced will be one quarter, one-half, and three-quarters the original; and if the tracer is fixed at 2, and the pencils at 3, 4, and 5, the copies will be double, three times, and four



PANTOGRAPH EXTRAORDINARY.

times the original drawing, and other variations can be made in similar proportions.

A SIMPLE HELIOGRAPH.

A is an inch plank, say 18 in. long by 6 in. wide, for steadiness; B is a fulcrum, 3 in. by 1 in. by ¾ in., chamfered at the top for C to work on; it is screwed on to A from underneath, say 5 in. from one end; C is a plain piece of wood, 15 in. by 1½ in. by ¾ in., hinged (without play) on to B, 5 in. from one end. The dotted line, D, is an ordinary stout India-rubber band (or it may be a steel spring), its use being to keep that end of C always down on A when not in use. At E, say 3 in. from fulcrum, bore a hole for the insertion of a wire, F, which has to carry the glass. Let the glass be a common round zinc mirror, 3 or 4 in. in diameter, cost-

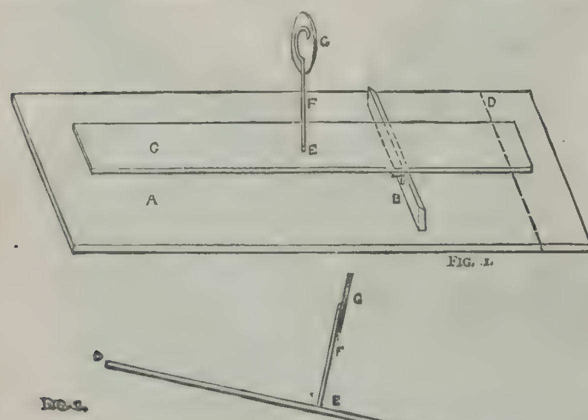


Fig. 1.—Plan in Perspective. Fig. 2.—Side View or Side Elevation.

A SIMPLE HELIOGRAPH.

ing 2d. to 4d. At the back, in the center, make a hole (with the point of a knife or small tool) through the zinc, paper, and whatever there may be, leaving the glass clear (less than ⅛ in. large); then solder to the back a piece of stout wire, F (⅛), pointing to the end, so that it will enter the hole, E. and support firmly the glass, G, leaving some 3 in. between the glass and plank, C. The instrument is now finished, and it only requires practice when the sun is shining to be able to speak with it as fast as any telegraph clerk can who uses the Morse code. A thick wedge or two to raise the stand, A, at one end or the other, according as the sun is high or low, will be found useful, and a lump of stone, iron, or other heavy substance, placed on the corners of A, will help to steady it. The glass can be twisted round by hand as it is found the sun is traveling. Should the sun be behind the operator, a second glass must be fixed, to throw its rays on to this glass.

FORGED TRELLISES.

For a short distance, like three miles, to ascertain that your flash is directly on your object, all that is required is a forked stick, stuck in the ground (dark, or with its bark on, is best), or a piece of plank cut V shape at the top, placed three or four feet or more from the glass. Look at your object through the little hole at the back of the glass, and see that the fork of the stick is in a direct line and level, and you need not again look at your object, but only observe that your flash each time strikes that particular part of the fork that you observed. For long distances you want two forked sticks, and with a telescope see that both forks are in a line with your object. Then your instrument must be raised or lowered so that your flash strikes both forks. Be careful not to let your flash travel above the spot on the stick that you have observed, or you will show two flashes—one while traveling upward and another as it comes down.—*Amateur Work.*

Furnace Heating.

In heating by furnaces, and in selecting them, the following points should be considered, writes F. E. Kidder, in the *Builder and Woodworker*:

1st. Be sure and put in a furnace capable of comfortably heating the building in the coldest weather without heating the fire-pot to red heat. The contraction and expansion due to the great changes of temperature in the furnace, when the fire has to be forced, soon loosen the joints of a furnace built up of several pieces, and permit the escape of the gases of combustion into the fresh air supply.

Wrought iron and steel plate furnaces are now made which are claimed by the makers to be superior to cast iron furnaces, but it has been shown that wrought iron furnaces may leak after having been some time used.

It seems to be the general opinion of manufacturers of hot air furnaces that no rule can be made by which one can tell what size furnace he should use to heat a given amount of space. They say the only thing to go by is experience, taking into account the exposure of the building, location of furnace, etc.; hence an architect must rely upon the recommendation of the manufacturer, and it is, therefore, best to deal only with those who have a good reputation.

2d. Cold air supply. Especial care should always be taken to secure a large supply of fresh air by means of a wooden or metal duct connecting the air chamber under the furnace with an opening in the outside wall of the building, preferably on the north or west side. This duct should be as large as the opening in the base of the furnace. The air supply should on no account be taken from the cellar, because it is almost sure to be contaminated with gases escaping from the furnace door, and, perhaps, there may be decaying matter or bad plumbing in the cellar, which also give off injurious gases.

The fresh air supply should not be brought in through an underground duct without taking especial precautions to have it air-tight, and should not pass across or near a drain or sewer.

3d. A furnace is usually placed near the center of a building, the object being to have the flues conveying the heated air from it as short as possible. Horizontal flues for heated air are very undesirable, as the friction in them checks the current and involves loss of heat. The direction of the wind has a great influence on the action of hot air flues, and for this reason it is better to place the furnace, not in the center, but toward that side of the house against which the winter winds blow most frequently and strongest. In the Northern States this will be toward the northwest. If a building of large area is to be warmed by furnace heat, it will be much better to use two or three furnaces distributed over the area than one large central one.

4th. The register and hot air flues should be of ample size, as it is much better to have a large quantity of air admitted at a low temperature than a small quantity of air at a very high temperature.

To Polish Hickory.

First clean all spots and rough places off. For this purpose use fine sandpaper, even if it does take a little longer, No. 1 for surfacing and No. 1½ for rough sanding. It will pay to do so. After sanding, rub a light coat of raw linseed oil on (take a rag to do so); add a little japan, about the same quantity you would if it was priming lead used. After it has dried in, take white shellac, thin with spirits of wine (or alcohol), and run over it lightly. After drying, sand down again and give it a stout coat of varnish. Rub down with pumice stone and oil, wash with castile soap and water, clean thoroughly, and give another light coat of rubbing varnish. Rub that down with pumice and water, finish, and your job is done. The reason we give it the oil first is that without it the shellac, if used, not having much, if any, penetrating power, the varnish is liable to scale off after being run a while in the weather. Also the same objection is found in putting the varnish on first; being quicker than oil in its setting qualities, it is not as good a penetrator as the oil. The oil is the safest plan. We prefer using oil to rub the first coat of varnish, because if there are any places rubbed through, the danger from the grain rising is not so great, because it does not stand so long in the water. The little time taken to wash it will not hurt it any. A polished wood job should not be striped, only the irons leaded and blacked off.—*Carriage Monthly.*

FRAME-CLOSING DRAWING BOARD.

It is rightly claimed by Woolff & Son, the sole manu-

Fig. 1.—THE FRAME-CLOSING DRAWING BOARD, CLOSED.

facturers, London, that the board is at once "effective, simple, and compact." This may be seen from Figs. 1 and 2, in which the construction of the board is clearly shown. From Fig. 2, it will be noticed that the board consists of a central piece, to which a framing is attached by slips of brass, screwed at one end to the board and at the other to the framing, so that the pieces of framing may be pushed close to or away from the edges of the board, after the manner of the two slips of which the ordinary parallel ruler is formed. The board is grooved at the edges, and the inner edge of each piece of framing is wedge-shaped, so as to fit into the groove to which it is opposite. The paper should be cut to the size of the board, including frame when closed. It must then be damped in the usual way, and placed evenly on the board with the frame open. The margin projecting over the edges of the

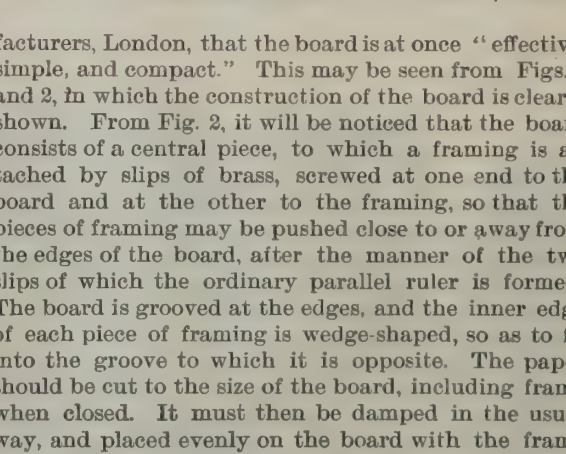
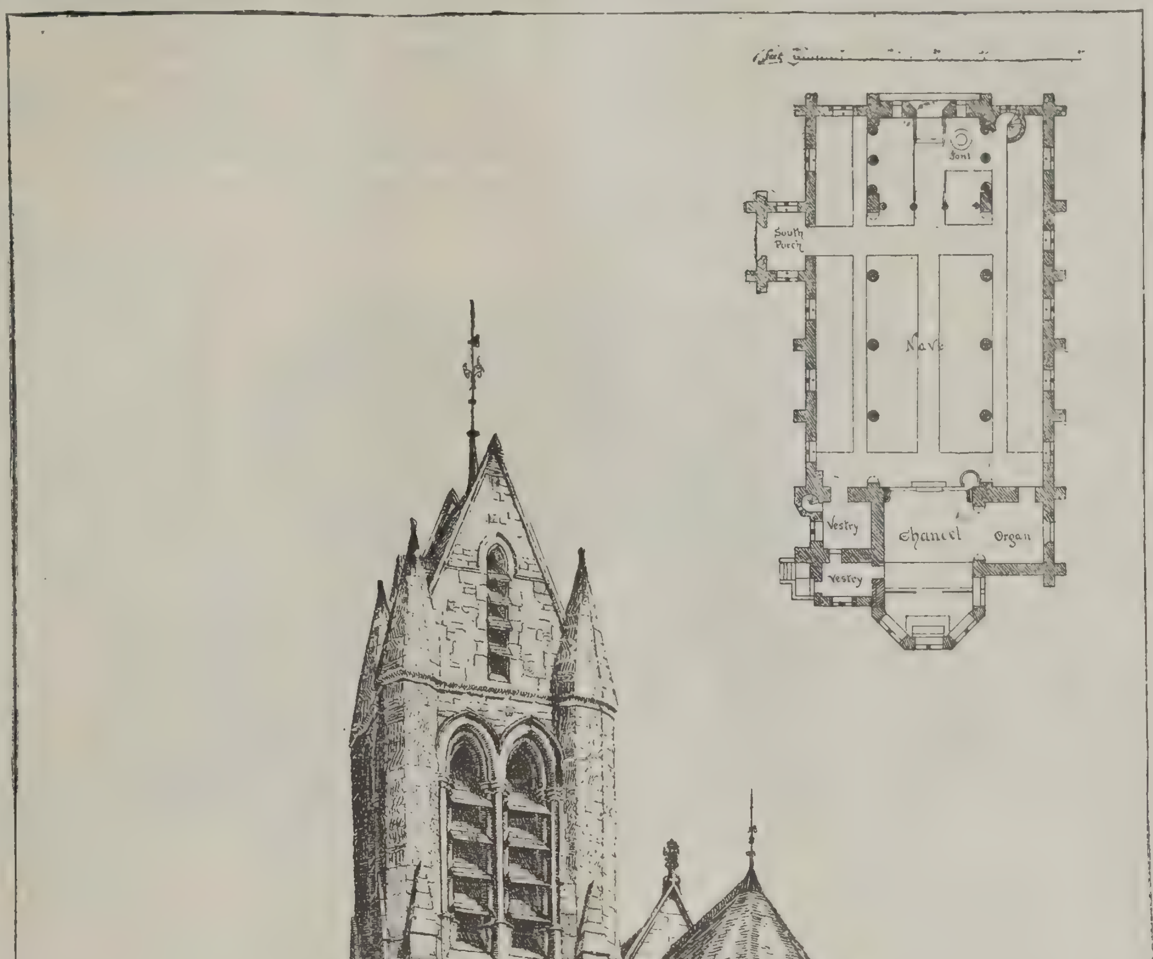


Fig. 2.—THE BOARD OPEN, SHOWING BACK OF BOARD.

board must then be creased sharply over them, and it is recommended that this should be done with a piece of clean paper. The framing must then be closed on the paper, and the angles pressed well together and fastened with the catches that are shown at each corner in Fig. 1. The corners of the paper need not be cut off. When the catches are fastened, the paper must be allowed to dry in the usual manner, and when dry will be found to be well stretched and perfectly even.

ST. JOHN'S CHURCH, MACCLESFIELD. ENGLAND.

This church is designed in the thirteenth century style, and is faced externally in coursed rubble, with local stone called Parpoint Tegsnose, from the neighboring hills. It is of a delicate pink color. The dressings to doorways, windows, and strings, etc., are executed in Hollington, also a local stone, and show tool marks. The interior is lined with dark red pressed bricks, relieved in arches, pillars, windows, and strings with rubbed Hollington stone. The roof is covered with reddish brown tiles, and internally is lined with match-boarding, divided into panels by moulded ribs and supported by carved principals, which spring from stone shafts, running up chancel and clerestory walls. A wooden shaft runs the whole length of building just above ceiling level, and carries off all foul air. Ventilation is provided for in windows, and also by gratings placed in sills of aisle windows, and communicating with outer air by flue in wall. The whole of the woodwork, except external doors, which are in oak, is in pitch pine, and was executed by Mr. Gladwell, of Macclesfield. The floor under seats is laid with White's block flooring, supplied by Messrs. Gregory & Son. The chancel is laid with ornamental tiles, and the passages in nave and aisles in plain red six inch tiles, with ornamental borders. The contractor for the portion already built was Mr. John Moore, of Macclesfield. It cost about $14,000, including fittings, etc. Mr. C. Gordon Killmister and Mr. R. A. Briggs, of London, are the joint architects.



S. JOHNS' FREE AND OPEN CHURCH, MACCLESFIELD, CHESHIRE.

Copal.

The copal from which varnish is made is found in a fossil state, chiefly on the east coast of Africa, and consists of the exudation of former forests long since submerged. It is never found far inland. Copal varies in quality according to the vicinity where it is obtained; sometimes two descriptions are unearthed in the same district, varying in quality, structure, and shape. The young copal of Sierra Leone is globular or tear-like, brownish and slightly odorous; the "pebble" copal obtained there is more or less white, with thick, opaque crust, and is odorless. That of Gaboon is in flat pieces, with a crust of branching striæ, and the fracture is conchoidal. The copal of Loango takes the form of broken sticks, of which there are two kinds, one white to yellow grain, the other reddish or brownish, and in irregular fragments. The latter, which is transparent, homogeneous, and fragrant, is the best. Of Angola copal one kind is globular, and of uniform quality throughout; another is in the form of sticks, mostly cracked, and is found in common with air bubbles and bark; it is yellow, red, or brownish. Slightly colored copal has a dull appearance, and is not so uniform or transparent as the strong colored. The copals of Manila, New Zealand, and South America are softer than other descriptions.

A FURNITURE manufacturer out West, referring to a competing manufacturer in a neighboring city, says a neighbor of his bought a bedstead of the latter's make, the wood of which was so green that one warm spring day it broke out all over with little groves of waving branches. In autumn the children picked the chestnuts from the side pieces, and the next spring tapped the headboard for maple sugar.

Compressed Wood.

The London *Engineer* describes the compression of beech and other woods by means of hydraulic presses, by Robert Pickles, of Bromley, England, who makes this wood a specialty for shuttles and for gearing. The compression of the wood improves its wear-resisting qualities to a degree that would be deemed impossible. The wood is first sawn into sizes necessary for making shuttles or cogs and naturally dried. It is then put under a pressure of about 15 tons per quare inch, in a rectangular space in the press, holding six shuttle blocks, three side by side and two deep. Above is a metal block made so as to fit the space in the ram. The depth of the blocks before compression is 2¼ inches, which is reduced to 1¼ inches. The woods generally used for this purpose are beech, cornel and persimmon. The grain is very close and the weight of compressed beech is considerably greater than that of boxwood, and when compared with uncompressed beech, it is remarkably heavier. In regard to the wear of the wood for cogs, it is stated that it will last a long time and run very easily.

"The Cock's Shrill Clarion."

A correspondent of the *Gardeners' Magazine* will earn warm thanks if he is right in saying that cock-crowing may be stopped thus: You suspend loosely a small lath a few inches above the spot where the noisy rooster is in the habit of perching. This in no way interferes with his comfort; but the moment he stands up and stretches his neck—as is the trick of such birds—in order to give utterance to the shrill toned cock-a-doodle-doo, the lath gently strokes his comb, and gives him a hint which is said to be effectual in silencing him. People who will persist in keeping poultry, though living in dwellings surrounded on all sides by other inhabited houses, would do well to take note of this simple contrivance.

Use of Clay to Prevent Leakages.

It is stated in the *Aberdeen Free Press* that Mr. Thomas Fraser, of King Street, Aberdeen, has discovered a new method of preparing clay for preventing leakage in reservoirs, water tanks, etc. Hitherto it has been the general practice, when clay has been used in connection with the construction of water works, and for other similar purposes, to apply it in a thoroughly wet and plastic condition. From a series of scientifically conducted experiments, Mr. Fraser has come to the conclusion that far better results can be obtained by drying the clay, and reducing it to a fine powder, before applying it to the bed of a reservoir or to anything which it is desired to render water-tight. A long connection with the brick and tile business led him to study closely the properties of clay, especially when used as a preparation out of which a variety of articles had to be manufactured. He learned from observation that in a wet state clay had reached its extreme point of expansion, and that water would then filter through it. Having ascertained this fact, he concluded that if clay were used for puddling in a dry, compressed state, it would absorb a certain percentage of water, expansion naturally following, and rendering the layer water-tight. The greater the pressure of water, the more satisfactory the results are said to be. Mr. Fraser began his experiments by selecting his clay from a special bed, out of which he cut a square. The specimen was carefully measured and weighed. After it was thoroughly dried, its dimensions and weight were again taken, when it was found that the clay had lost 25 per cent in weight, while the shrinkage was 10 per cent. Clay in this dry state is extremely hard and compact, and if put into water and not allowed to expand, it would require a long time before water would penetrate to the center of a 3 in. tube. Another specimen of clay, from the same bed as the former one, was dried and reduced to a fine powder. In this loose condition it absorbed about 75 per cent. of the water which filtered through it. When the clay was prevented from expanding, it was found to absorb 50 per cent. of water, which filtered a little. Powdered clay to the depth of 6 in. was pressed into a tube 8 ft. long by 3 in. in diameter, and having 2 in. of perforated zinc at the bottom. The tube was then filled with water, with the result that the clay absorbed 35 per cent, but there were no traces of filtration. Mr. Fraser is confident that the method he has hit upon, besides being more efficient, is also more economical in every way than the manner of using puddled clay now in vogue. He is sanguine that it could be beneficially applied in covering arches, in preparing a perfect bed for street causewaying, etc.

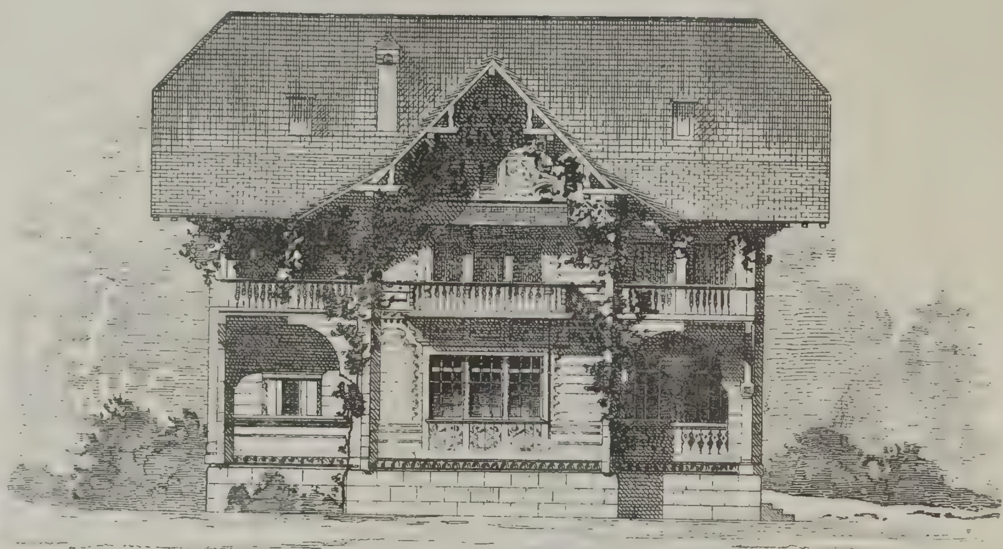
Ventilation for Schools.

An instructive paper on "School Ventilation" was read the other day by Mr. Hector, of Aberdeen, before the School Board Clerks' Conference at Brighton. Mr. Hector referred, says the *Building News*, to a contribution read at a recent congress in Glasgow by Mr. W. Jolly, one of H. M. inspectors of schools, in which that gentleman said it was surprising that with all our scientific progress we are still so practically ignorant in regard to the effective removal of foul air and the introduction of tempered pure air. Patent appliances have, as Mr Hector has shown in his paper, dealt with only one side, as, for example, the revolving ventilators, cowls, and outlets, which only act when the wind is in motion, but which cease to act when the wind is inoperative, or pull against each other rather than together at other times. The same inactivity is found to exist in the case of the Tobin tubes, which depend for their operation on the condition of the external atmosphere. If the outside air is not in motion, or is moving away from or past the inlet, complete inactivity is the result. Ventilation by open doors and windows is not to be wholly depended upon, for what can be endured by one teacher or pupil cannot be tolerated by another. A teacher may find no ill consequence from open windows, but a child in one position may do so. The weak and helpless have to endure a condition which the strong and robust do not feel, or can afford to neglect. Draughts from doors and windows cause all kinds of ailments in children; toothache and neuralgia are frequent causes of complaint, and parents make strong objections to their children being allowed to sit near open windows. Any system which depends on the constant attention of teachers is not to be relied on. Mr. Hector proceeds to show that ventilation may take place irrespective of attention to those means, and that fresh air may be admitted tempered to the required condition, and also in such a manner as to aid in expelling the foul air. He referred the conference to a series of drawings, showing the system carried out in ventilating a school now being built in Aberdeen, and his description is briefly as follows: The school is of the type commonly seen in Glasgow and Govan. The class-rooms converge on a central hall or staircase lighted by a cupola. The basement is used as a covered playground, from which the staircases ascend to the various parts of the building. In the rear of the school two upright shafts, with an internal area of twenty square feet, rise from the basement to the height of the topmost window, at which point louvre openings give admission to the fresh air in each shaft free from surface dust.

The shafts unite in the basement, where an air propeller is fixed in an opening and driven at a speed of 350 revolutions per minute by a gas engine of $3\frac{1}{2}$ horse power. The gaseous fumes from the engine chamber are not allowed to mingle with the fresh air. The fresh air chamber occupies a large space in the basement, into which the fresh air is propelled. It runs parallel to the well of the staircase to about the center of the building, which it then crosses at right angles. It is brick built and air-tight, coated smoothly with cement. Air is driven down into it at the rate of 16,000 cubic feet per minute. A screen to filter the air of dust and impurities should be fixed in the center. The outlets from this chamber consist of two horizontal cold-air shafts running from end to end of the building above the chamber and under the ground floor. Along each of these cold air flues are a couple of hot flues, into which the air passes when warming is necessary, and in these side flues the hot water pipes are hung, which are usually placed along the skirting of the rooms. The air is heated by contact with these pipes, and enters by small branch flues into the rooms above. It enters each room in a thin, continuous stream, the wooden linings of the rooms being projected forward about 2 in. to permit of its doing so. To aid in diffusing the air, it is made to escape at a point in the wall below where it entered. Finally, it escapes by a series of upcast shafts recessed in the wall and lined with wood; through these it enters the open attic or roof space, and its final exit from the building takes place at two towers, which have each an area of 20 sq. ft. These towers have louvre openings on the four sides, and the air escapes at one side or the other, according to the direction of the wind. Behind each louvre opening is placed an automatic valve frame on which is fixed successive rows of thin waterproof cloth. The slightest breath of wind coming through the louvre opening closes the waterproof valves, those on the opposite side opening simultaneously, through which the air escapes. The system described is one by which the air is simply laid hold of, the fan being the motive power. The Aberdeen School Board have made very careful examinations on rival systems of ventilation. The reports of the scientists appointed show that the air in the school-rooms ventilated by natural means with open windows contained a larger volume of carbonic acid gas than was healthful, while in the schools ventilated by mechanical means the carbonic acid gas was much less. The results are intended to show that when the fans are at work the proportion of carbonic acid is reduced by upward of ten volumes per 10,000, and when the number of scholars is properly limited, and the fans are efficient, the air supplied would contain not more than ten volumes of carbonic acid in 10,000, a proportion considered desirable in a well ventilated room. The fans used in these schools were designed by Mr. W. Cunningham, of Dundee, the consulting engineer to the board.

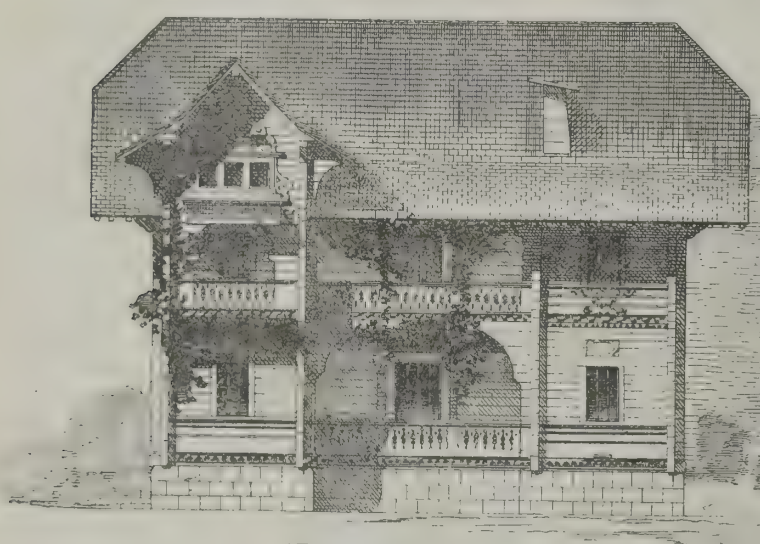
SHINGLES can be made fireproof by setting the butts into a trough of water in which half a bushel each of lime and salt and six pounds of potash have been dissolved.

Fig. 1



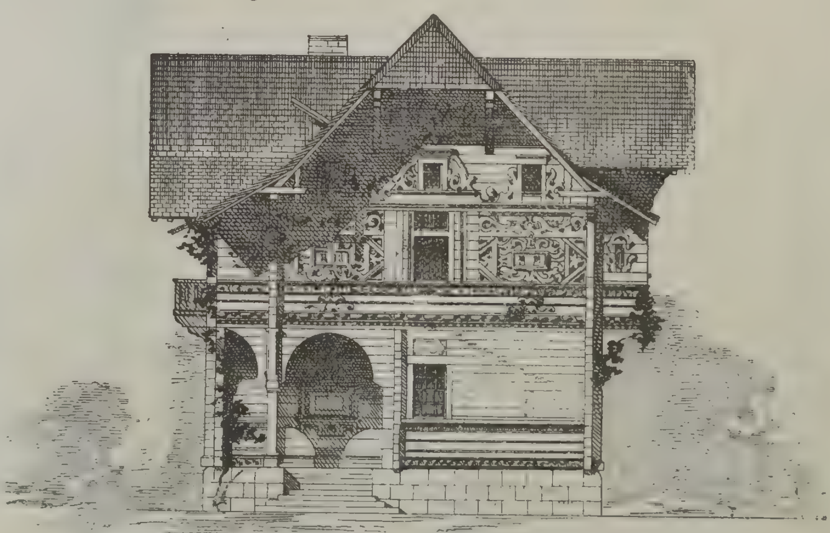
FRONT ELEVATION

Fig. 2



REAR ELEVATION

Fig. 3



SIDE ELEVATION

A SWISS COTTAGE.

A SWISS COTTAGE.

The accompanying figures represent a Swiss cottage, after a model exhibited at the last *Salon* by M. Ruy, a Parisian architect. The elegance and peculiar style which are the essentially dominant and artistic qualities of these kinds of structures would not alone have led us to study the arrangements of them, had we not found therein, at the same time, a special system of construction that comes more particularly within the scope of this journal. In fact, we have here one of those Swiss structures, entirely of wood, called block houses, the walls of which are formed of superposed beams. Taking this structure as a type, we shall very briefly give a general idea of Swiss buildings, the figures themselves, with all the details, speaking to the eye well enough to allow us to dispense with a prolix description. The basements alone are of masonry. They are of undressed stone, are about one and three-quarter feet in thickness and four and a quarter feet in height. Many Swiss cottages have no cellar, the owners being content with cellars located at a distance from the house; but when one does exist, it is very rarely vaulted. The most improved system consists in laying a double flooring on a level with the ground, so as to well isolate this story.

As we have stated, the external walls are formed of superposed beams. These are fastened together with cherry or oak pins driven in here and there. These beams are about eight inches in thickness. In order to avoid loss of heat, they are hollowed out at the joints, and the space is filled in with well dried moss. The best of wood is used for the sills, and these are given a height of 11 inches and a thickness of 8. As an offset to the shrinking of the wood as it dries, and which does not occur with the posts, the latter are made a little shorter than the height of the pile of beams. The window and door lintels are usually wider than the wall.

The woodwork generally used for these structures is the red fir of the country (*Pinus abies*), which behaves very well when exposed to the air, and which acquires a beautiful brownish red color. Oak and other hard woods are very little used.

The internal divisions are of beams for the bearing walls and of upright or horizontal planks for the simple partitions. These partitions can be closed up at will by means of a wedge-shaped plank, when such a thing becomes necessary through a shrinkage of the wood, due to drying.

The covering is of shingles, which overlap, and are nailed to each other. The roofing, as usual, is without a truss. The bearing walls support the trimmers.

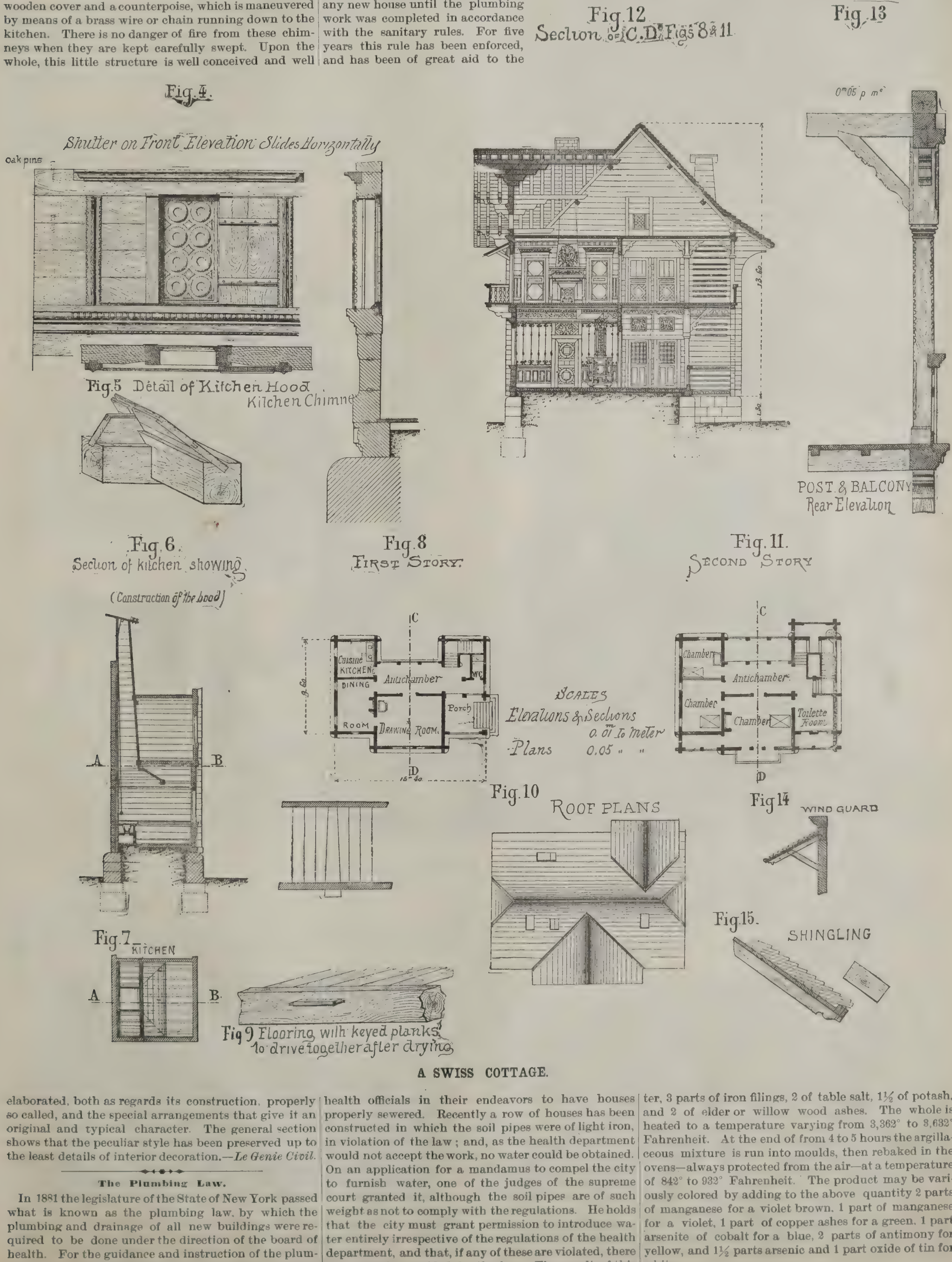
Swiss cottages are more commonly covered with scantling, and, in order to prevent this from being blown off by the wind, the roof is loaded throughout its entire length with large stones under which are placed planks that are fixed by their extremities to the rafters with pins. But this system is not applicable where the roof has so steep a pitch as that so judiciously adopted by M. Ruy.

The flooring is of fir planks, $1\frac{1}{4}$ in. thick, miter jointed and set into the ground-sill. The length of the rooms determines that of the plank, which, for greater stiffness, are supported from wall to wall by a beam of 7×7 inch section. One of the planks is beveled off in the form of a wedge, the wide end of which projects through an aperture in front; this plank is driven in in

measure as the drying causes a shrinkage of the flooring, so as to tighten the joints and keep the floor stiff.

The rooms are heated with stoves. As may be seen, the stove pipes must be arranged with great care in order to prevent fires, which are much to be feared in structures wholly of wood.

The kitchens have one peculiar feature, and that is the large wooden chimney, whose hood often (as in the case under consideration) extends over more than half the room. These chimneys extend in pyramidal form above the ridge, and are provided at the top with a wooden cover and a counterpoise, which is maneuvered by means of a brass wire or chain running down to the kitchen. There is no danger of fire from these chimneys when they are kept carefully swept. Upon the whole, this little structure is well conceived and well elaborated, both as regards its construction, properly so called, and the special arrangements that give it an original and typical character. The general section shows that the peculiar style has been preserved up to the least details of interior decoration.—*Le Genie Civil.*



A SWISS COTTAGE.

The Plumbing Law.

In 1881 the legislature of the State of New York passed what is known as the plumbing law, by which the plumbing and drainage of all new buildings were required to be done under the direction of the board of health. For the guidance and instruction of the plumbers, rules and regulations were established governing the construction of the works referred to in the law. Some of the plumbers violated these rules in various ways, among others, by putting in iron pipe of a less thickness than was permitted. Although such a violation was made a misdemeanor, it was found that houses might be constructed with serious defects; and, before any legal measures could be taken, the houses would be occupied, and the health of the occupants imperiled. In order to assist the health department in the enforcement of the law, the city works commissioner passed a rule that Ridgewood water should not be furnished to any new house until the plumbing work was completed in accordance with the sanitary rules. For five years this rule has been enforced, and has been of great aid to the health officials in their endeavors to have houses properly sewered. Recently a row of houses has been constructed in which the soil pipes were of light iron, in violation of the law; and, as the health department would not accept the work, no water could be obtained. On an application for a mandamus to compel the city to furnish water, one of the judges of the supreme court granted it, although the soil pipes are of such weight as not to comply with the regulations. He holds that the city must grant permission to introduce water entirely irrespective of the regulations of the health department, and that, if any of these are violated, there is a remedy provided by the law. The result of this decision, says *Science*, will be to embarrass the health department, temporarily at least, although ultimately it will doubtless find some way of speedily punishing offenders against the law.

Improved Bricks.

For obtaining products that will offer greater resistance to humidity, etc., than ordinarily is the case, an improved process of manufacturing bricks has been brought forward in Germany. After drying and grinding the clay, a mixture is made of 91½ parts of the latter, 3 parts of iron filings, 2 of table salt, 1½ of potash, and 2 of elder or willow wood ashes. The whole is heated to a temperature varying from 3,362° to 3,632° Fahrenheit. At the end of from 4 to 5 hours the argillaceous mixture is run into moulds, then rebaked in the ovens—always protected from the air—at a temperature of 842° to 932° Fahrenheit. The product may be variously colored by adding to the above quantity 2 parts of manganese for a violet brown, 1 part of manganese for a violet, 1 part of copper ashes for a green, 1 part arsenite of cobalt for a blue, 2 parts of antimony for yellow, and 1½ parts arsenic and 1 part oxide of tin for white.

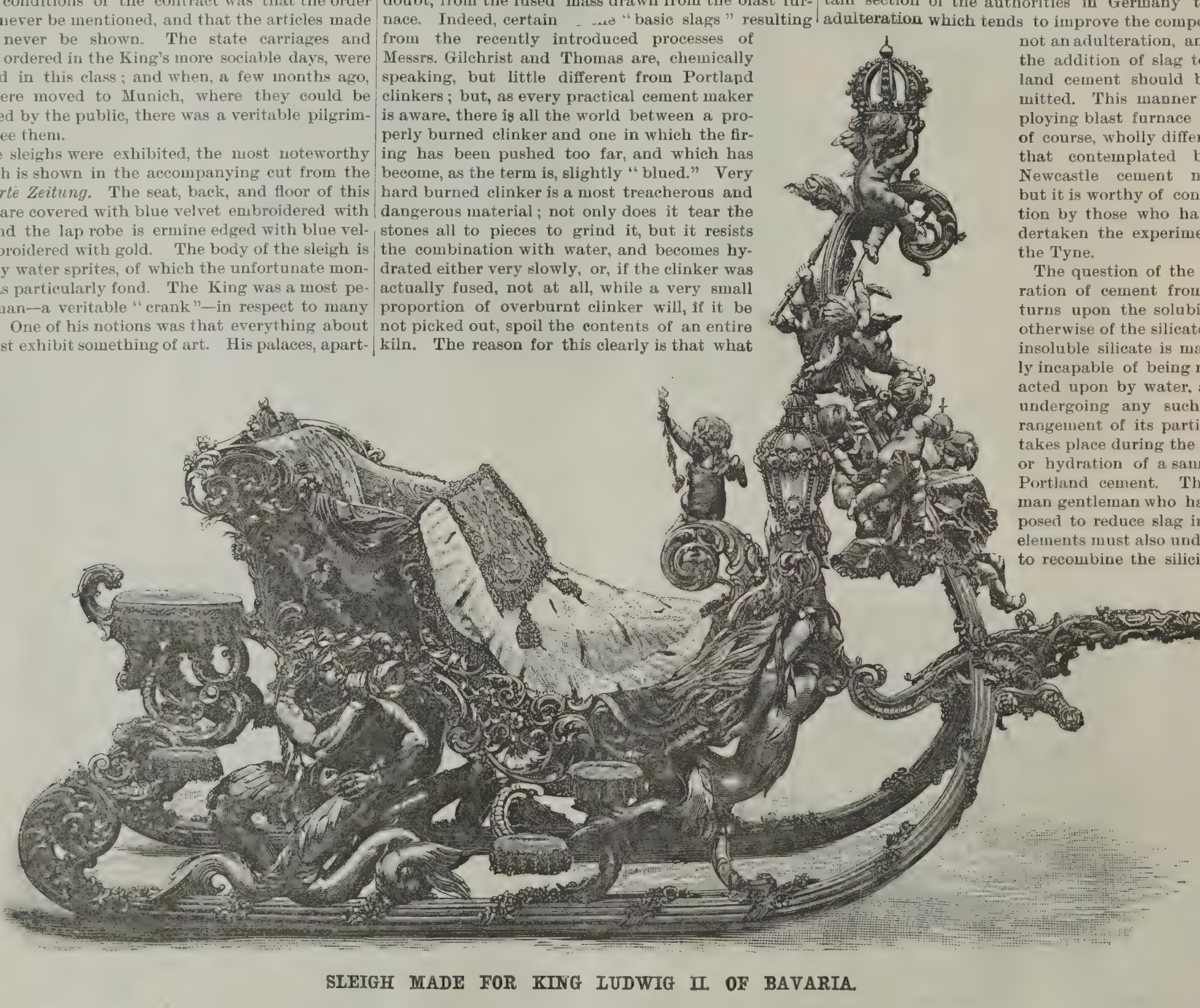
An Interesting Monument.

M. Clermont-Ganneau has communicated to the Academy of Inscriptions and Belles Lettres a note relative to a discovery made by him in an old building at Jerusalem. It was a block of stone, with a Greek inscription signifying that any stranger who should have passed that limit would be condemned to death. It is evidently a fragment of one of the posts which formed, in the temple built by Herod, a dividing line between the exterior inclosure of the Gentiles and the inner precinct reserved for the Jews. It will be remembered that St. Paul barely escaped stoning when he was accused of having introduced Greeks into the inner circle with himself. The stone has been removed to Constantinople, but a cast has been taken, which will be preserved in the Museum of the Louvre.—*Cosmos.*

SLEIGH MADE FOR KING LUDWIG II. OF BAVARIA.

The reserve of the late King of Bavaria surrounded his person, as well as everything belonging to him, with a certain mystery. Very few ever saw any of his personal effects, for when anything was made for him, one of the conditions of the contract was that the order should never be mentioned, and that the articles made should never be shown. The state carriages and sleighs, ordered in the King's more sociable days, were included in this class; and when, a few months ago, they were moved to Munich, where they could be inspected by the public, there was a veritable pilgrimage to see them.

Three sleighs were exhibited, the most noteworthy of which is shown in the accompanying cut from the *Illustrirte Zeitung.* The seat, back, and floor of this vehicle are covered with blue velvet embroidered with gold, and the lap robe is ermine edged with blue velvet embroidered with gold. The body of the sleigh is borne by water sprites, of which the unfortunate monarch was particularly fond. The King was a most peculiar man—a veritable "crank"—in respect to many things. One of his notions was that everything about him must exhibit something of art. His palaces, apartments, furniture, all were of the most artistic character, executed without regard to cost. This sleigh, a magnificent work in its way, is only a small example of his many idiosyncrasies.



SLEIGH MADE FOR KING LUDWIG II. OF BAVARIA.

Slag Cement.

The possibility of using the slag or scoria resulting from the smelting of iron and other metals for the production of cement, is an idea that has presented itself to many inventors, and has engrossed a vast amount of time, hitherto with very little practical result. We read that this subject has attracted the attention of "several cement manufacturers on the Tyne banks," and that experiments are being made "to utilize the residuals from the blast furnaces in making Portland cement of higher quality than that produced by the ordinary process." A short time ago the Middlesbrough ironmasters spent a good deal of money in similar attempts, and before that we were assured that Mr. Ransome had succeeded in turning various descriptions of slag to profitable account in the preparation of cement said to be superior to Portland cement. So far, however, the new cement has made but little impression on the market, and we are almost despairing of its ultimate introduction. To the superficial observer this problem is doubtless an attractive one. Portland cement, even in these days of competition and low prices, is a relatively costly material, and iron slag is a drug upon the market, and a commodity which some people have even to pay to get rid of; and if, indeed, by some simple process we could convert these millions of tons of scoria into cement, not only would the production of iron become cheaper than ever, but the manufacturers of Portland in the ordinary way would have to close their works, while, with cheaper cement, one more excuse for bad mortar and jerry building would be removed.

So far, however, the would-be inventors, though they may have been skillful chemists, have shown them selves singularly unable to deal with the chemical facts involved in the production of Portland cement; and though we have to some extent considered the chemical aspects of this question on previous occasions, it may, perhaps, not be amiss to remind our readers, and those who take an interest in this important subject, of certain facts which militate sadly against the employment of slags for the manufacture of Portland.

The double silicates of lime and alumina, burned to the point of incipient vitrification to form the clinker of Portland cement, vary but little in composition, no doubt, from the fused mass drawn from the blast furnace. Indeed, certain ... "basic slags" resulting from the recently introduced processes of Messrs. Gilchrist and Thomas are, chemically speaking, but little different from Portland clinkers; but, as every practical cement maker is aware, there is all the world between a properly burned clinker and one in which the firing has been pushed too far, and which has become, as the term is, slightly "blued." Very hard burned clinker is a most treacherous and dangerous material; not only does it tear the stones all to pieces to grind it, but it resists the combination with water, and becomes hydrated either very slowly, or, if the clinker was actually fused, not at all, while a very small proportion of overburnt clinker will, if it be not picked out, spoil the contents of an entire kiln. The reason for this clearly is that what we have to prepare is a double silicate, capable of hydration, that is to say, capable, when reduced to a fine powder, of entering freely into combination with and of solidifying a certain proportion of water, and of thus binding together the particles of stone, gravel, sand, etc., with which the cement is employed. When the silicates have been fused, or "dead burned," we get a crude glass, as little capable of becoming hydrated on admixture with water as so much sand would be, or we obtain, perchance, a large proportion of these inert silicates, mixed with a quantity of feebly hydraulic silicates of a most dangerous and unreliable character, some of which will inevitably "blow" in the work, *i. e.*, combine with water only after the surrounding particles have set, and have become more or less indurated.

It is, of course, well known that molten slag, when run into water, is mechanically reduced to a very fine state of subdivision, and the silicious particles thereby produced have long been used in place of sand. Some slags, also, when exposed to the action of the atmosphere, will "weather" or crumble, owing to some slow decomposition of the silicates, and to the presence of iron in small quantities. We have yet to learn that the decomposition of slag could be at once effected by any chemical means which should, as is stated in the article from which we quote, "reduce it to its elements of silica, lime, and alumina" in an uncombined form. Such a chemical discovery would indeed be one of marvelous significance. Many years ago, while this plan of making Portland cement from slag was unthought of, it was proposed to add to molten slag an excess of slaked lime, in the belief that it might be possible in this way to produce hydraulic limes at a cheap rate; but the difficulties of introducing the lime, and of causing it to become thoroughly and intimately mixed with the slag, were found to be insuperable, and the silicates produced were, even with a large excess of lime, extremely insoluble.

Strangely enough, though the ordinary varieties of slag are so inert in themselves, they have some of them the power of rendering hydraulic substances, with which they are suitably mixed, even more hydraulic, and of stimulating in this way chemical action; and it has been proved by Dr. Michaelis that it is possible to improve a good sample of Portland cement by adulterating it with a small proportion of crushed slag. That this action is not simply a mechanical one is proved from the fact that other inert substances have not a similar effect, and it is contended, therefore, by a certain section of the authorities in Germany that an adulteration which tends to improve the compound is not an adulteration, and that the addition of slag to Portland cement should be permitted. This manner of employing blast furnace slag is, of course, wholly different to that contemplated by the Newcastle cement makers, but it is worthy of consideration by those who have undertaken the experiments on the Tyne.

The question of the preparation of cement from slags turns upon the solubility or otherwise of the silicates. An insoluble silicate is manifestly incapable of being rapidly acted upon by water, and of undergoing any such rearrangement of its particles as takes place during the "set" or hydration of a sample of Portland cement. The German gentleman who has proposed to reduce slag into its elements must also undertake to recombine the silicic acid with the lime and alumina in a form capable of gelatinizing when treated with acid, and this, we fear, he will fail to do without exposing them to a good red heat—a costly matter to obtain, as the cement maker full well knows. The saving to be effected by the use of the new process would in this event be that only of the cost of the raw materials, less the expense of reducing slag into its elements (which surely cannot be done for nothing), and in this case the cement makers elsewhere need not alarm themselves. If, on the other hand, the German patentee has discovered a means of detrifying slag, and of giving us a compound which requires no firing and which grinds itself, and all this as a sort of supplement to the reduction of the aforesaid molten slag into its elements, we can only say that his invention is one of the most wonderful we have ever even dreamed of.—*G. R. R., Building News.*

Milan Cathedral.—According to article 6 of the programme of the international competition for designs for a new facade of the Cathedral of Milan, the Academy of Arts of Milan has published the names of the first 11 members of the international jury who have to select the best plans presented in competition. Mr. Alfred Waterhouse has been chosen for England. The other four members of the jury are to be chosen by the competitors themselves.

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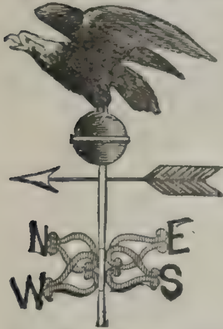

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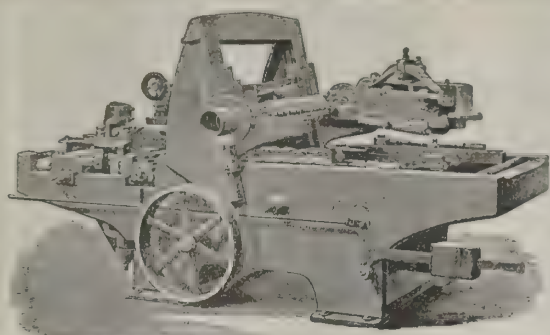

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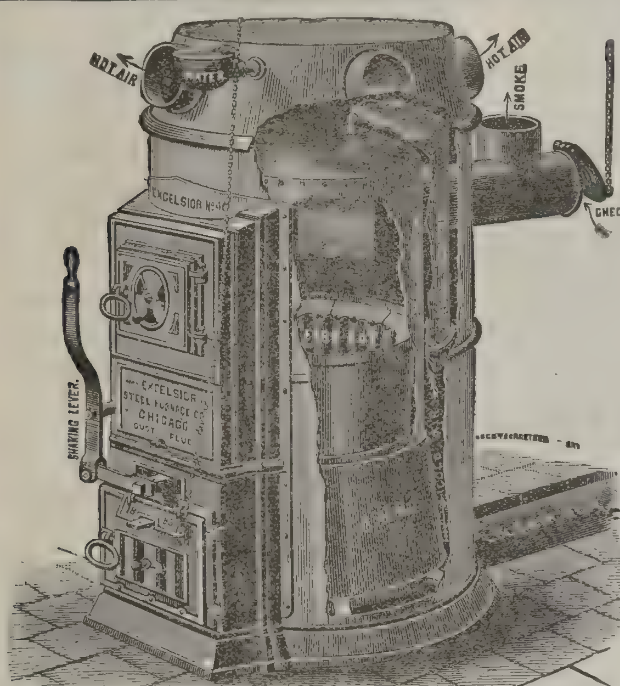

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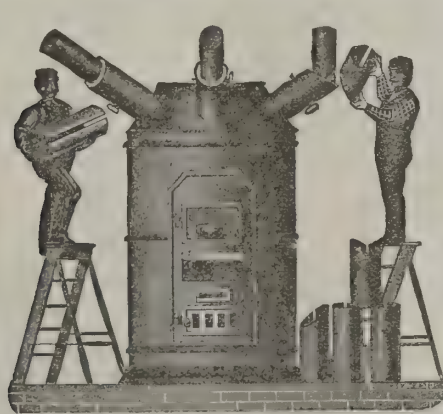

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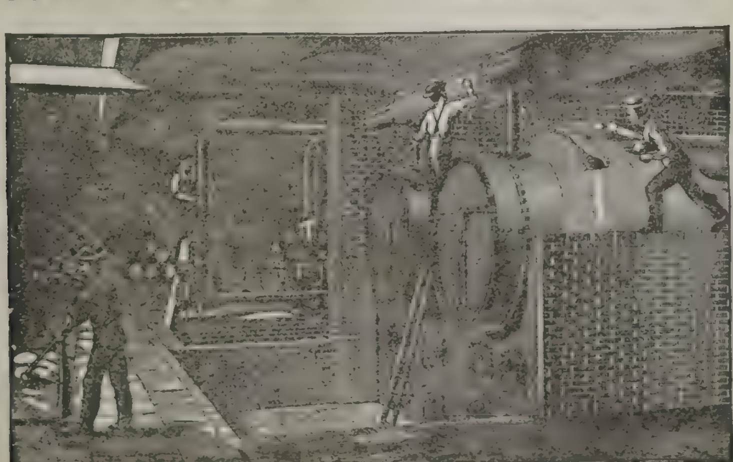

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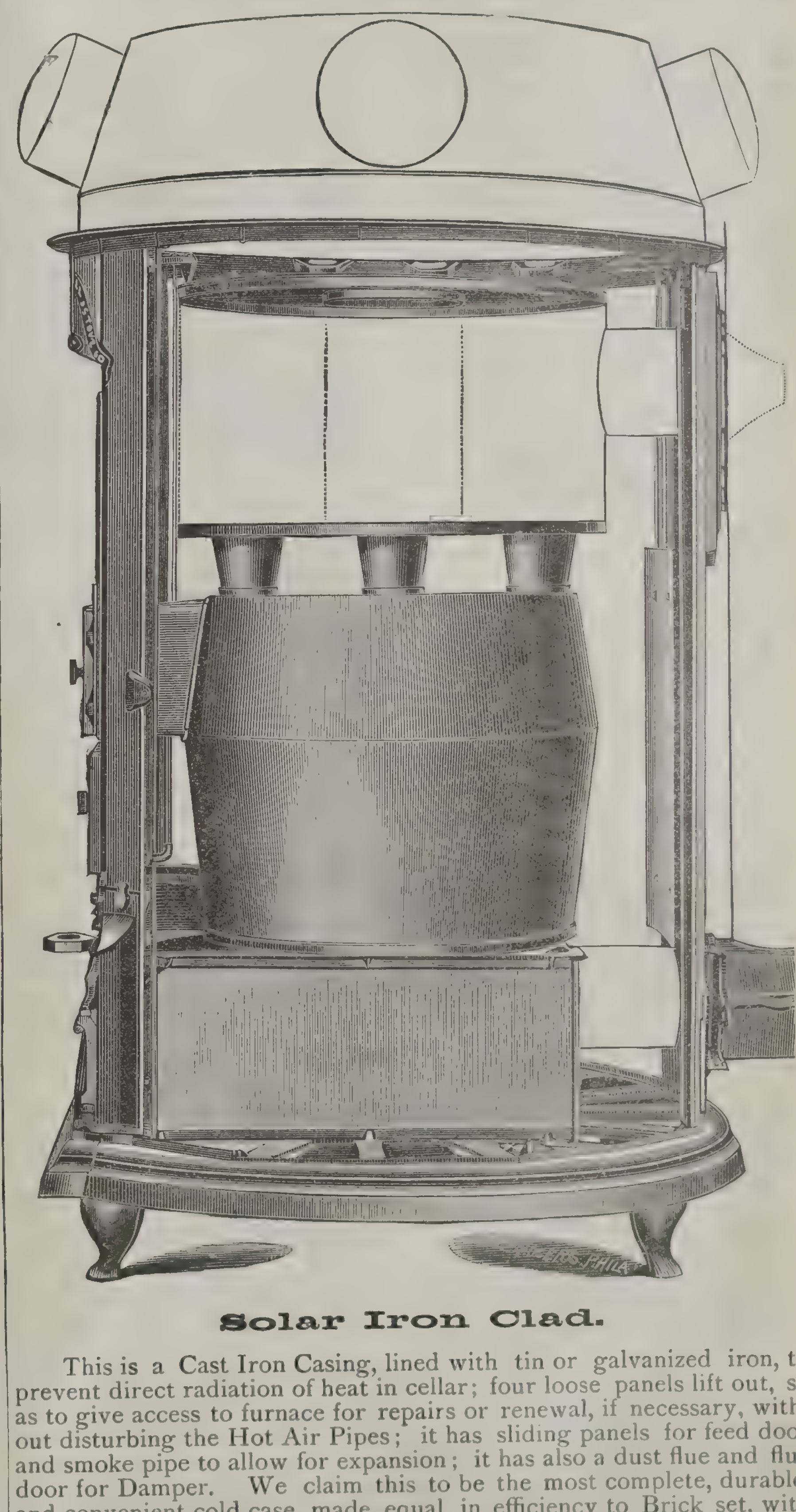

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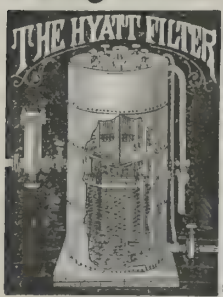

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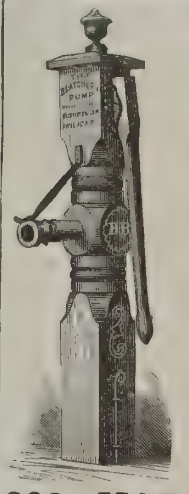

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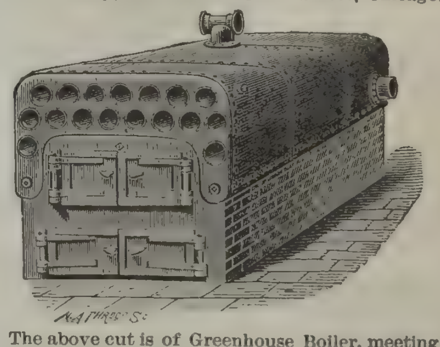

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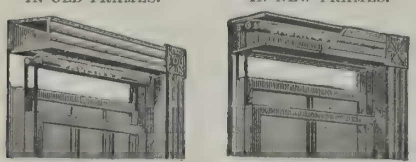

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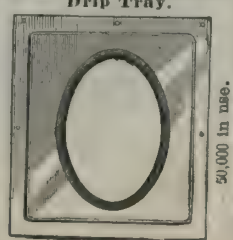

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FIG. 5.

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FIG. 3.

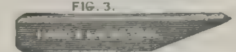
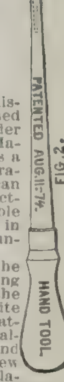


FIG. 4

FIG. 1.

FIG. 2.



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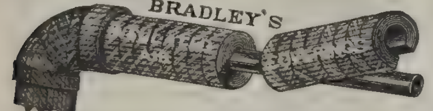

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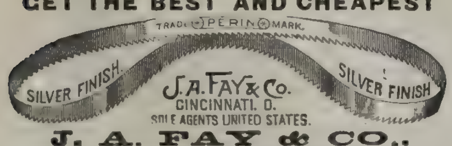

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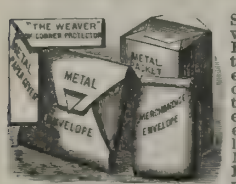

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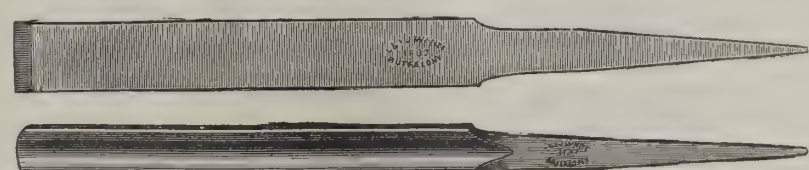

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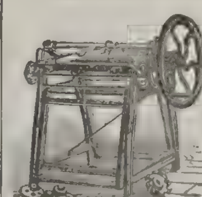

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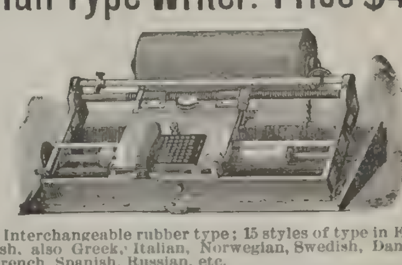

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) M. R. T. asks (1) a recipe for black paint for iron smokestacks. A. Use coal tar if it can be had; next, lampblack and boiled linseed oil, or plumbago paint. 2. For preventing boiler scale. A. We recommend a study of Davis' book on boiler incrustation. It treats of various kinds of water and scale. We can furnish it for $2.00. 3. What causes the roaring or humming noise produced by acoustic telephones, and why is it at intervals instead of being constant? A. The humming noise of the telephone is mostly caused by wind, or an induction from some other source of noise.

(2) C. S. M. asks how to prepare a polish (or dressing) for furniture, whereby old furniture may be made to assume a bright and new appearance. A. Melt three or four pieces of sandarac, each of the size of a walnut, add one pint of boiled oil, and boil together for one hour. While cooling add one drachm of Venice turpentine, and if too thick a little oil of turpentine also. Apply this, and after some hours rub off. Make frequent applications.

(3) A. E. H. asks: What is the best material for polishing brass, especially hot brass? A. Mix together 1 ounce oxalic acid, 6 ounces rottenstone, and a half ounce gum arabic; all these are to be finely powdered. Then add one ounce sweet oil and sufficient water to form the mixture into a paste. Apply a small portion to the article to be cleaned, and rub dry with a flannel or wash leather. See "Spons' Workshop Receipts," second series, which we can send you for two dollars.

(4) E. M. R. wants a No. 1 cement for cementing hot air furnace and stoves. A. The following cement, used for steam pipes, will probably be found satisfactory: Litharge 2 parts, powdered slaked lime 1 part, sand 1 part. Mix the mass with a sufficient quantity of hot linseed oil varnish to form a stiff paste. This cement must be used while fresh and warm.

(5) J. K. asks how to get out the white stain which alcohol makes on varnish, without painting it over. I am informed there is a preparation which you need only to rub over it to take the stain out and polish it at the same time. A. As the alcohol dissolves the varnish, the spot cannot be removed, except by renewing the varnish. The article to which you refer is probably some simple alcoholic solution of shellac.

(6) S. & C. ask how to keep the frost, moisture, etc., off plate glass windows. A. Only by keeping the inside air dry, or by inner sash made tight, so that the air in window inclosure will be cold, and ventilated from the outside. A partial remedy is to have ventilating openings in the top of the window casing.

(7) I. S. F. wishes to know the contents of a wall measuring 3 feet by 12 feet by 30 feet. A. The wall contains 1,080 cubic feet. If it is a rubble stone wall, it will be measured by the perch of 25 cubic feet, and will contain 43⅕ perches. If it is masonry, it will be measured by the foot cube; and if brickwork, by the number of bricks it contains, viz., 24,300.

(8) E. E. S. asks: 1. Will you give some kind of wash or stain for brickwork that will protect the brick and not wash off without oil, and be permanent? A. To make a good wash for external purposes, mix 1½ bushels of white lime with 3 pecks of hydraulic cement (say Rosendale or Portland) and add sufficient water and color as may be desired. Another is formed of ½ bushel of slaked quicklime mixed with ¾ pound of sulphate of zinc, 1 pound of common salt, and 1 gallon of sweet milk. 2. What is understood by a sounder (telegraphic) of 20 ohms? Does it mean 10 ohms on each spool and 20 on the pair? Or does it mean 20 ohms on each spool? A. A sounder of 20 ohms means one having a total resistance of that current on both bobbins. 3. Will a core made of ¾ inch iron wire do for magnet core on 20 ohm sounder? A. It would.

(9) F. E. O. asks (1) how to protect an iron abutment post of a bridge from rusting in contact with the earth above the water line, below water, and when alternately wet and dry. A. Cover with a coat of asphalt or coal tar, and then surround with pure Portland cement. The part of the post that is subject to wet and dry should be thoroughly cleaned and painted with two coats Prince's metallic paint in boiled linseed oil. 2. A simple way of repairing a rubber boot that has half an inch square of the rubber coating peeled off the linen. A. Use rubber cement to cover the peeled patch, two or three coats.

(10) G. L.—Varnishes formed of amber, asphaltum, or copal, or a mixture of them, and used in the process of japanning, are usually termed japans or japan varnishes. An explanation of the technical terms given in your letter may be obtained on reference to "Oils and Varnishes," by James Cameron, which we can send you for $2.50, or to "A Treatise on Volatile and Fat Varnishes," by E. Andres, price $2.50.

(11) P. C. R. asks how he may get rid of dry rot. A. The following mixture applied as a coating to timber is said to prevent the spread of dry rot: Oil of cassia, wood tar, and common train oil, mixed in equal proportions. The better plan, if practicable, is to remove the cause which gives rise to the fungus, and which is, in most cases, a want of ventilation.

(12) A. S. asks whether there is any substance which will dissolve the grease accumulated in the drain pipes of a kitchen sink. A. Dissolve common lye in boiling water and pour down the sink while hot.

(13) J. W.—The usual manner of removing thick whitewash from stone walls and ceilings is to scrape it off, and, where this cannot be done, to water-wash it several times, until thoroughly soaked, when it will come off with the brush. The only way of curing the dampness on your wall, without stripping paper, is to protect on the outside. The following solution is generally effective: Melt ⅛ pound of strong soap in 2 gallons of water and carefully apply it to the wall, without lathering. Then mix ¼ pound of alum in 2 gallons of water and, after allowing it to stand for about 24 hours, apply over the soap. See that the earth around building is graded to throw all surface water away from building.

(14) P. P. H. asks: 1. How to polish, smooth, and brighten wooden (pitch pine) floors? A. This information is given on page 312 of SCIENTIFIC AMERICAN for November 17, 1883. 2. How to stain rattan chairs to imitate mahogany and ebony? A. Wash the rattan with a concentrated aqueous solution of iron acetate having a strength of 14° B. Repeat this until a desirable shade is produced. Then give a coat of quick drying varnish, such as can be made by dissolving black wax in spirits of wine. 3. How to regild much used gilt frames (without using the varnish and gold powder)? A. We fail to understand how it is possible to regild frames unless the size or varnish be employed with gold leaf or powder. 4. How to fix looking glasses where the quicksilver is partly gone, and with black spots? A. See SCIENTIFIC AMERICAN for November 10, 1883, answer to query No. 23, for this information.

(15) J. C. asks us if the following, which appeared in a Chicago paper, is correct: How many cubic feet are in a stick of square timber 1 foot square at one end and tapering to a point at the other, and 100 feet long? The answer was 25 feet. Orton & Sadler's calculator gives the rule for finding the solid contents of squared or four-sided timber as follows: "Multiply the breadth in the middle by the depth in the middle, and that product by the length for solidity." A note says: "If the tree taper regularly from one end to the other, half the sum of the breadth of the two ends will be the breadth in the middle, and half the sum of the depth of the two ends will be the depth of the middle." In this case the breadth and depth of one end would be 0. Following the rule, the breadth and depth at the middle would be six inches, and the example would be 6 times 6, equals 36 inches, multiplied by 100 feet, equals 3,600, divided by 144, equals 25 cubic feet. A. We believe this answer to be correct. Haswell's rule for computing the volume of a pyramid is, Multiply area of base by perpendicular height and take one-third of product. This will give us a cubic contents of 33⅓ feet.

(16) T. J. T. asks: 1. How long will cottonwood, Linn. (basswood) and red elm last in fence pickets? A. Basswood, when well preserved and painted, is very durable, and might last for pickets as long or longer than pine—perhaps twenty years. Cottonwood is almost as durable when painted and preserved from the weather. Red elm is not durable for this use. 2. What is the best and cheapest preservative for that kind of wood when exposed to the open air? A. Common paint, linseed oil, and the brownish-red oxide of iron make one of the best outdoor paints. 3. What is their value compared with yellow or white pine? A. Southern yellow pine would perhaps be better than basswood or cottonwood, but white pine would be no better for outdoor use.

(17) W. S.—1. The painting and bronzing of radiators retards their heating qualities. 2. The horizontal pipes along the sides of the room are more efficient than when placed vertically, as in radiators with the same amount of surface in both.

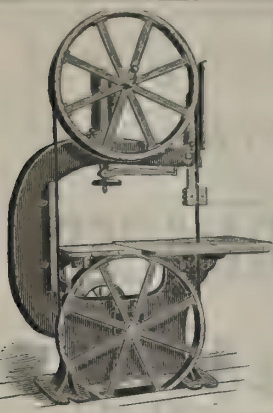
(18) S. P. C. asks for a simple method to prevent the reverberation of sound in a school room. A. Rough finished walls and ceiling are better than hard, smooth finish. Paper hangings with dead finish or flock surface or flock figures will sometimes break the sharpness of the reverberation. Curtains hung upon the walls or windows. They can be of muslin or cheese cloth, tastefully hung. Sometimes on only one side, opposite the speaker, will accomplish the purpose. In a school room, large maps hung between the windows, illustrating the daily teaching, are both instructive and very useful as anti-reverberators. They are on sale by the school book publishers of New York and probably St. Louis.

(19) A. C. B. desires the formula for indelible tracing paper. A. Transfer paper is prepared by rubbing the surface of thin post or tissue paper with graphite, vermilion, red chalk, or other pigment, and carefully removing the excess of coloring matter by rubbing with a clean rag.

(20) W. H. R. writes: About 30 feet in front of my residence, which is a Queen Anne cottage, runs a telegraph line. From the poles of this line are stretched six wires, at a height about level with my roof. The chimney upon my roof extends probably six feet above level of highest wires. Now, do these wires afford any protection to the property from the dangers of lightning? Some say the wires protect it, and some say not. I confess I see no reason why they should, but it is said that no house or barn was ever known to be struck by lightning near a telegraph or railroad line. What is good, full, and exhaustive treatise on lightning protection? A. We think the telegraph wires would tend to protect your house against lightning; but your house should have a system of lightning rods well grounded to furnish the best protection. You will find three books on lightning protection in the Scientific American Book List.

Business and Personal.

Any person having a new invention may, without charge, consult MUNN & CO., Scientific American Office, 361 Broadway, New York, for advice how to obtain a Patent or Caveat. Our Hand Book of Instructions relating to Patents sent free.



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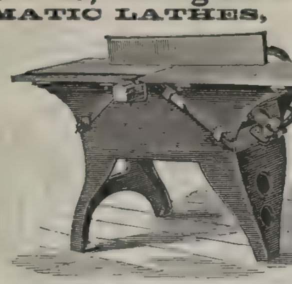

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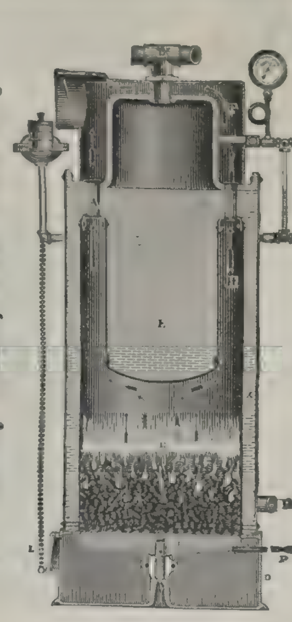

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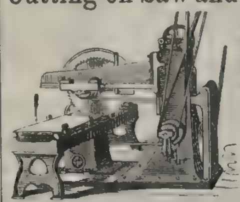

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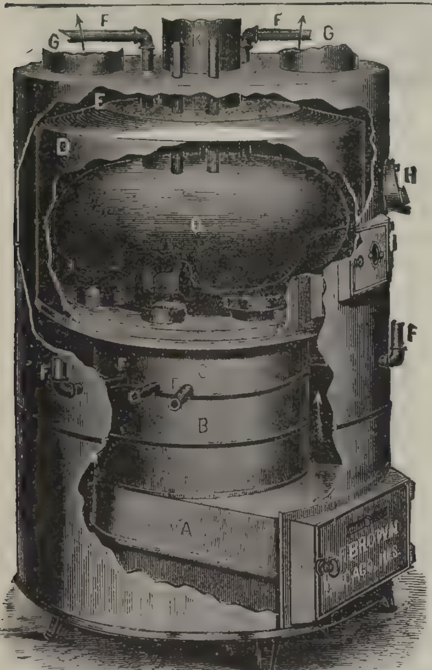

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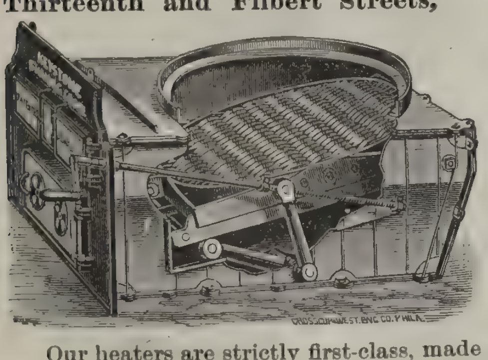

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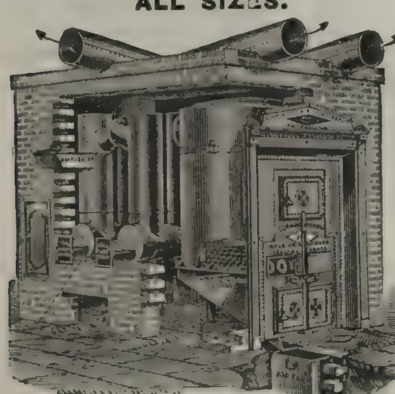

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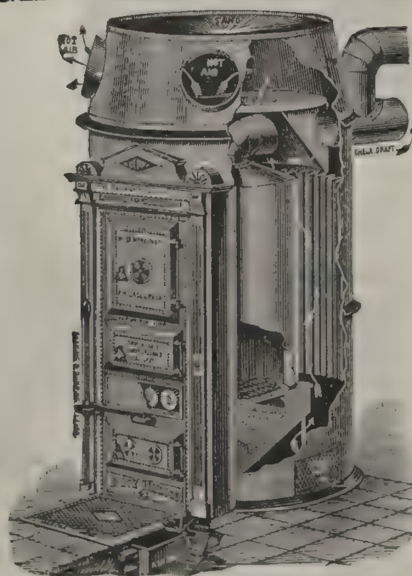

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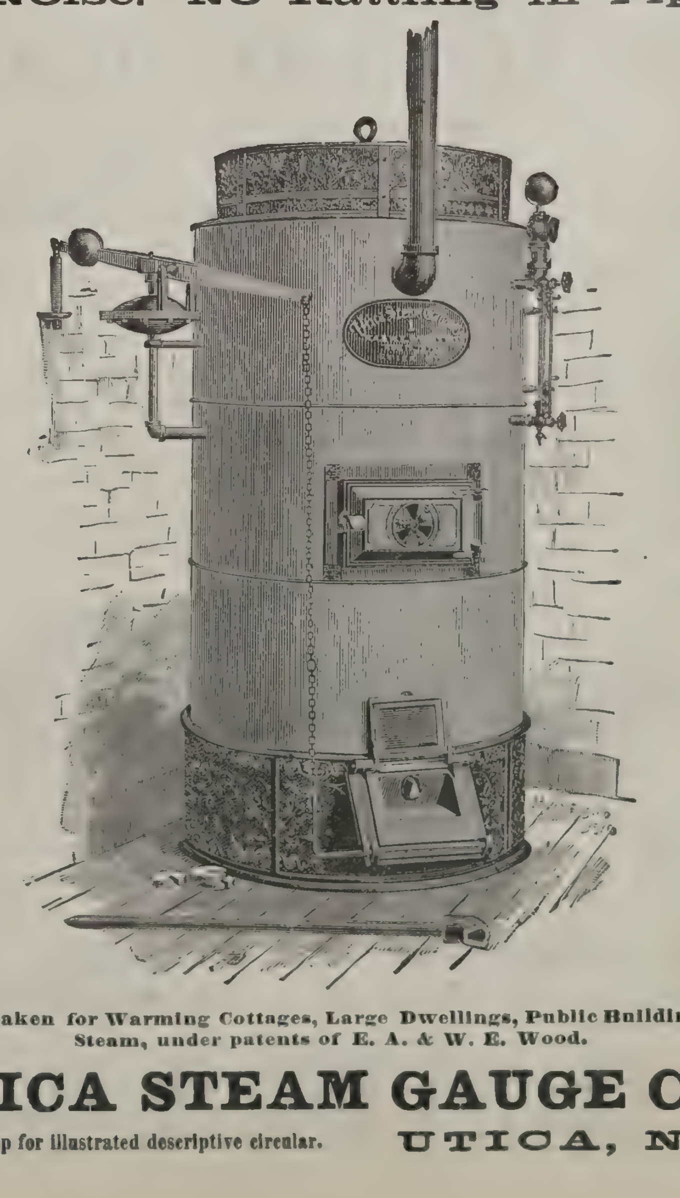

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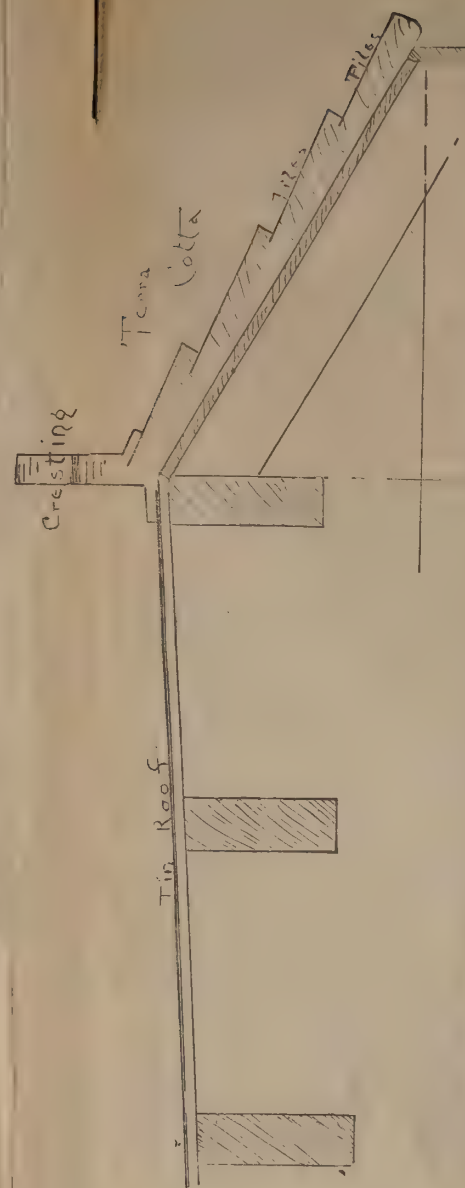

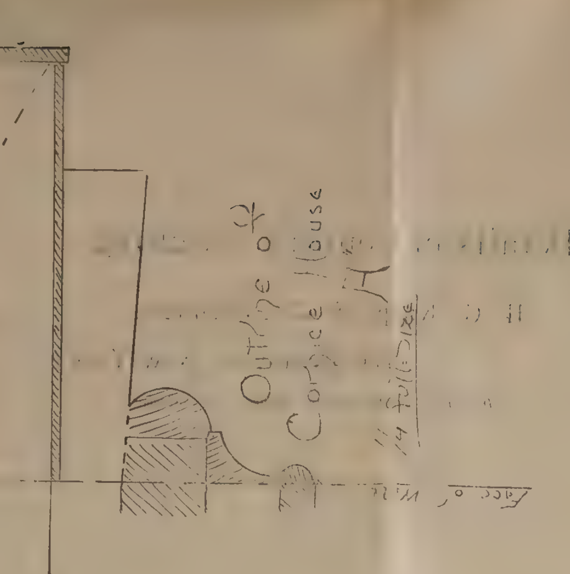

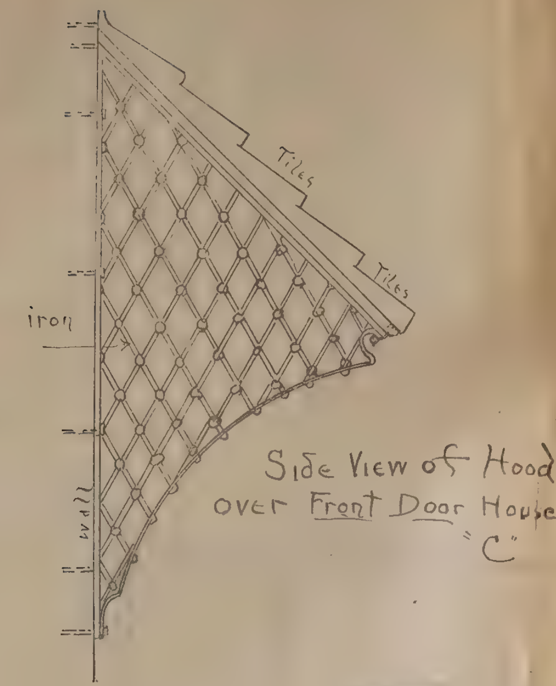

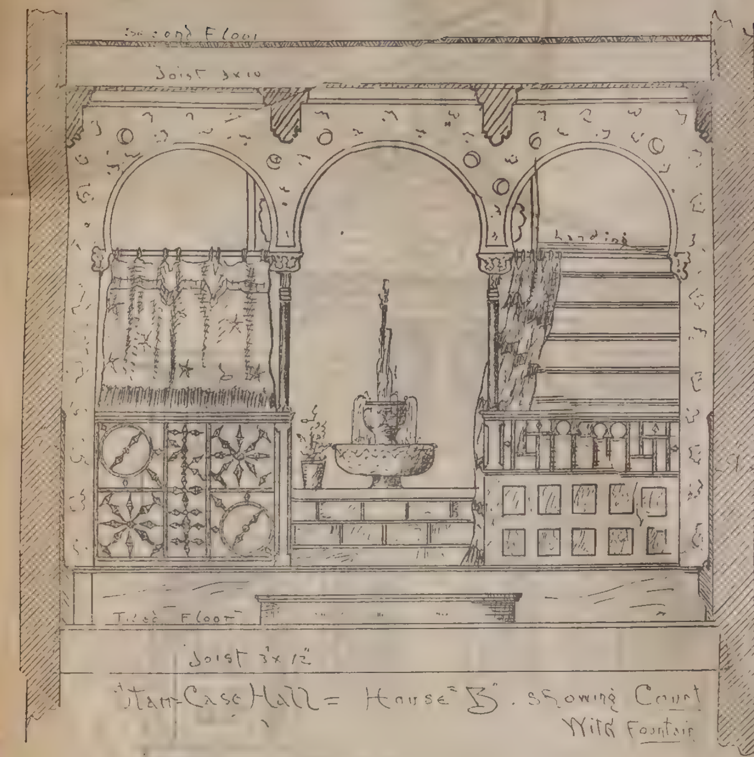

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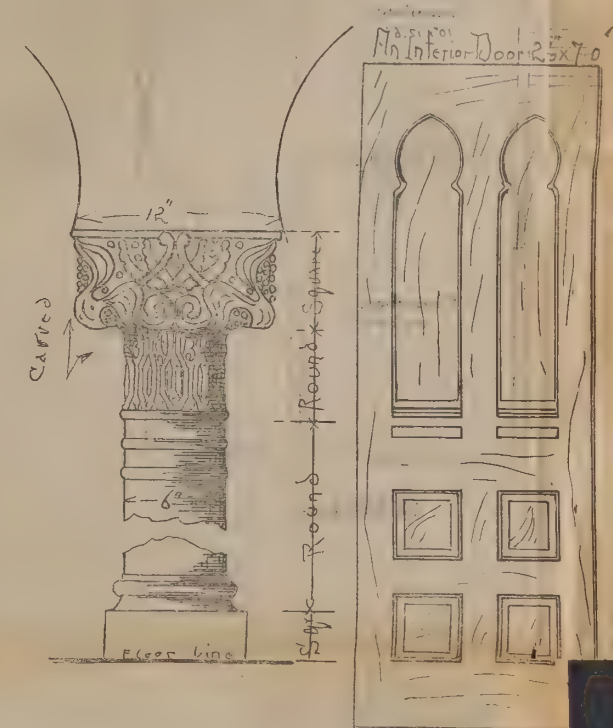
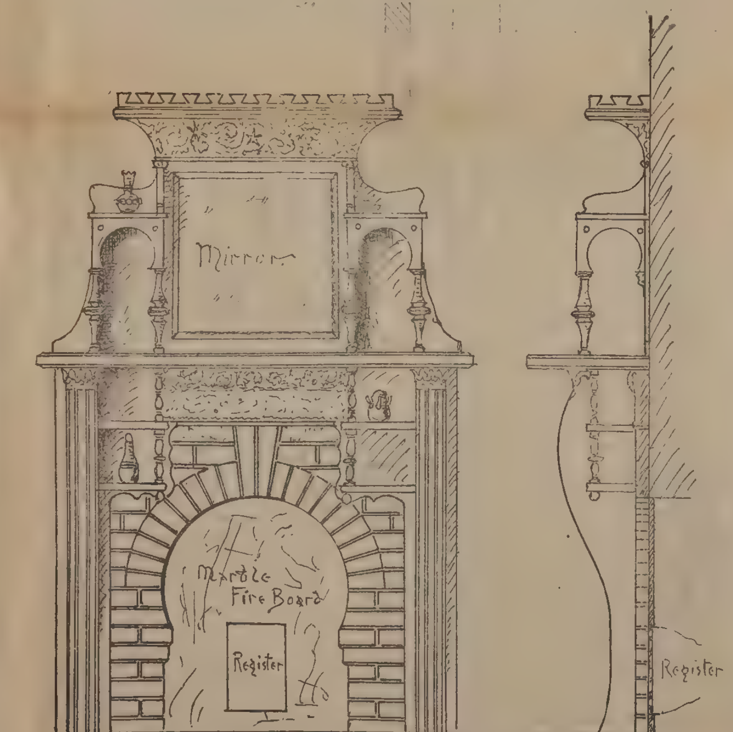
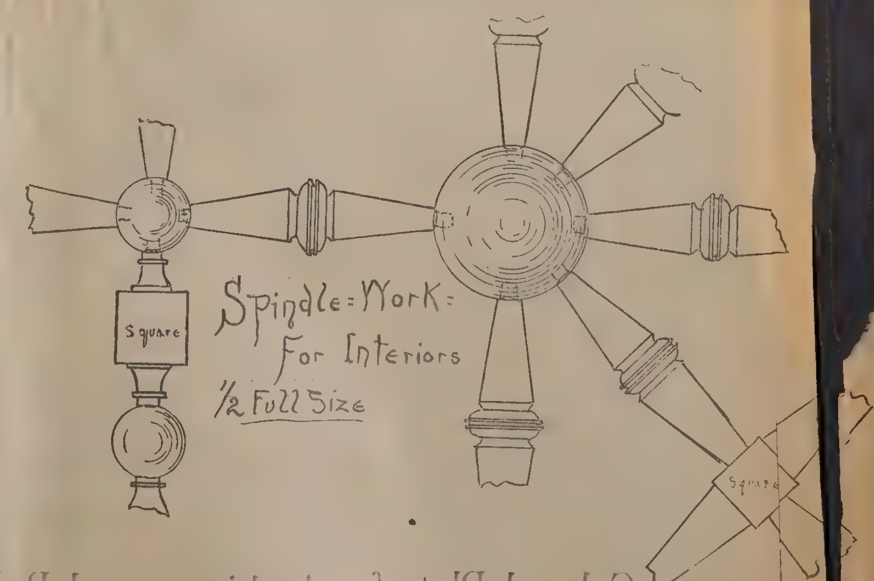
W. Claude Frederic, Architect,
Baltimore, Md.

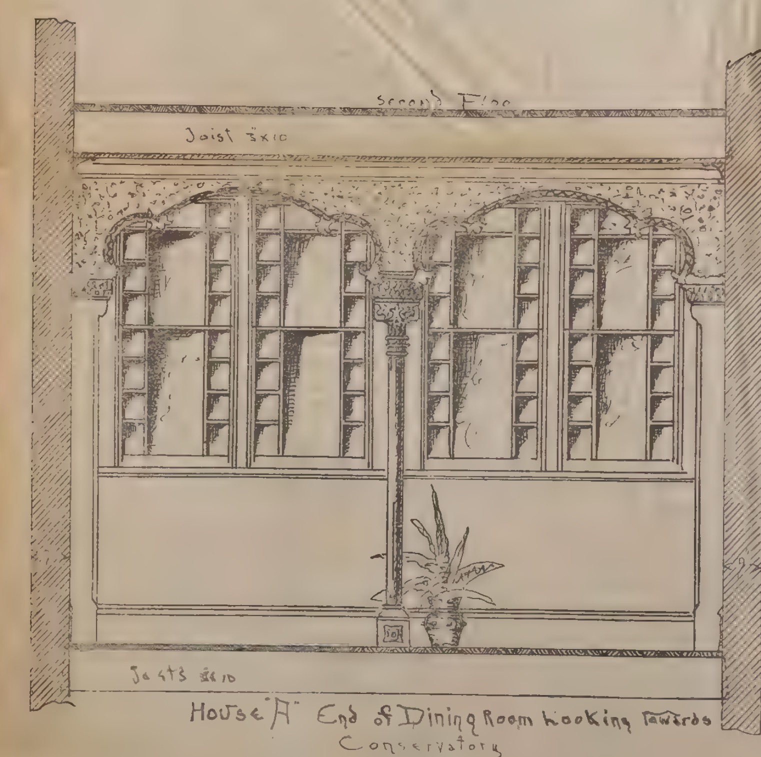


Basement Plans



= One of the Mantels = 1" Scale = End =





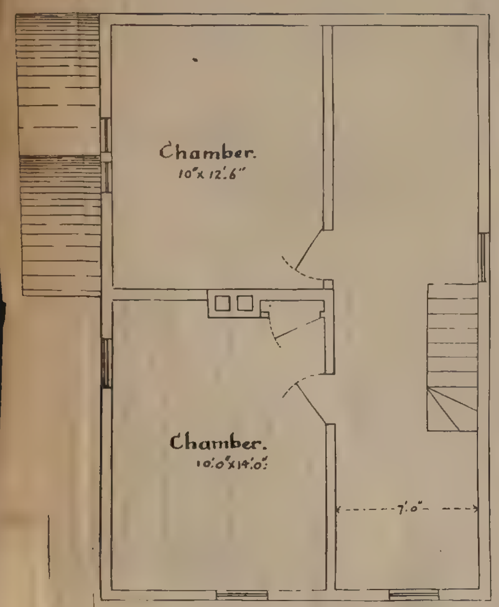
Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for December, 1886.

Details of Country Dwelling.

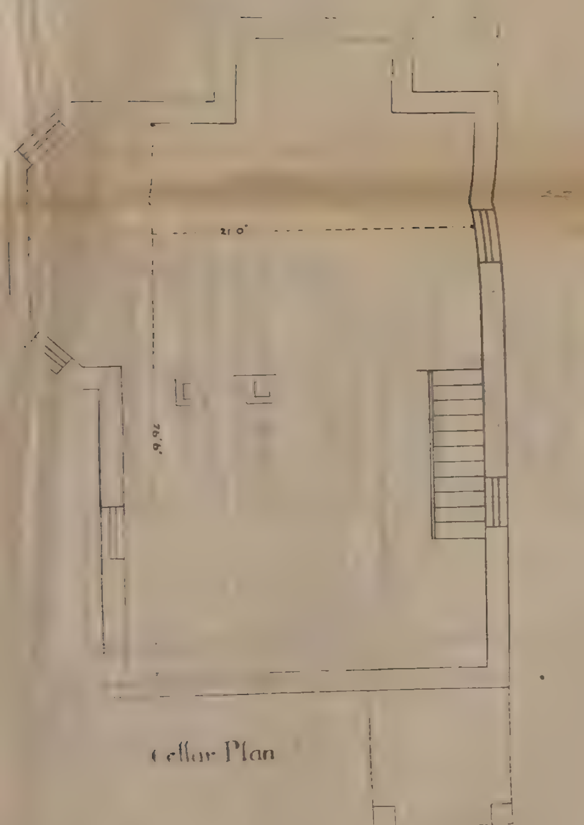
H. G. Knapp & Co., Architects,
176 Broadway, New York.

(*Description will be given in January, 1887, Number.*)

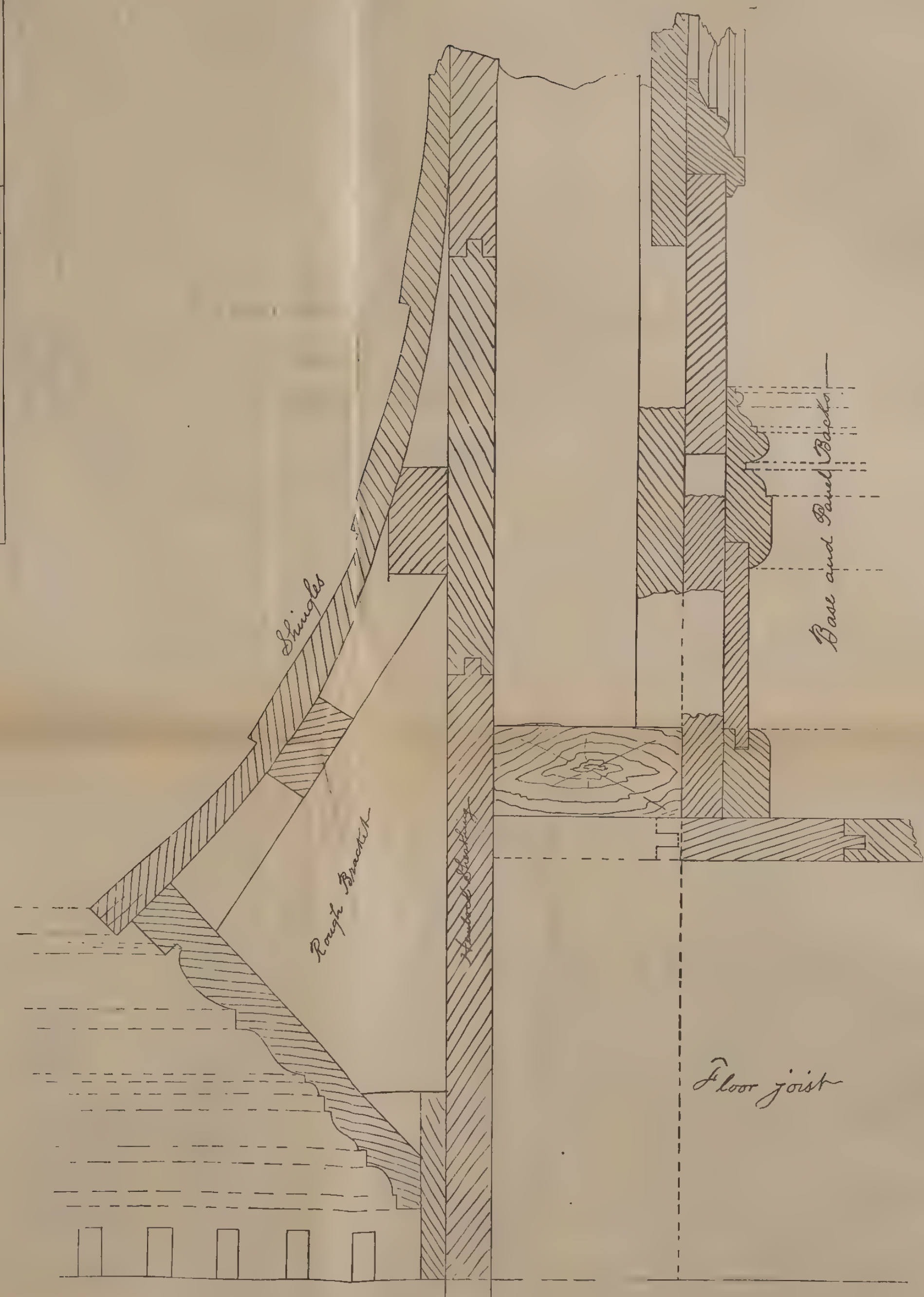
Alternative Elevation.



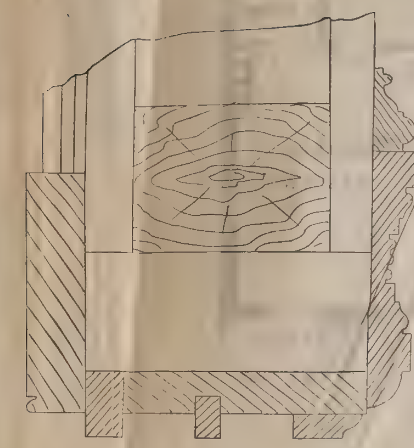
Attic Plan.



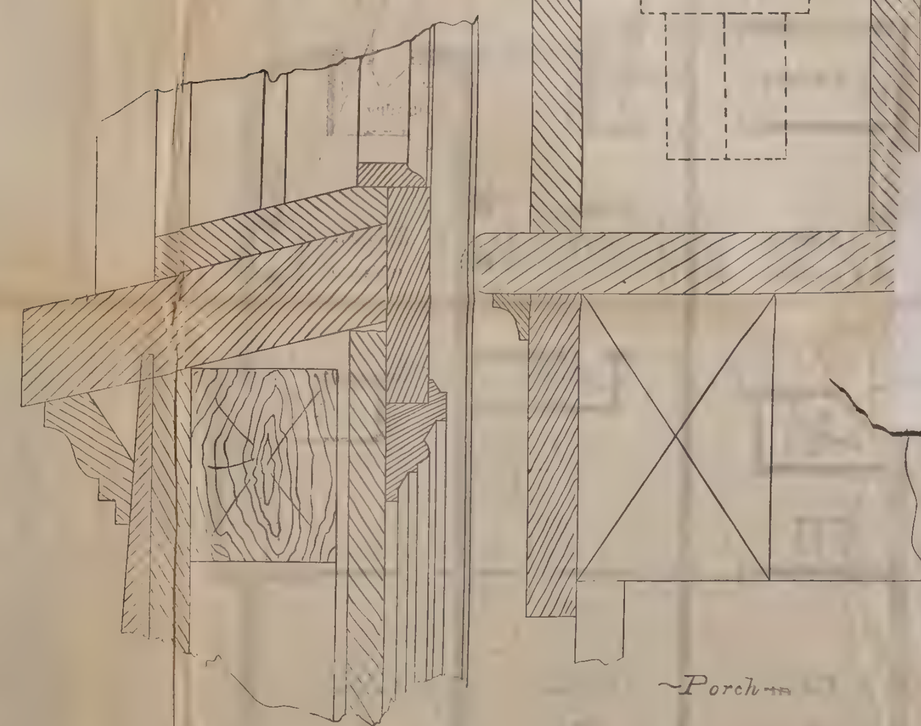
Cellar Plan



Detail of Belt Cornice



Window Frames



Porch

Details to accompany Colored Plate for Architects and Builders Edition of Scientific American for December, 1886.